AIR CONDITIONING HEATING AND VENTILATING

DECEMBER 1960

For the Engineer
Engaged in DESIGN
APPLICATION
ESTIMATING
SPECIFICATION
and LAYOUT

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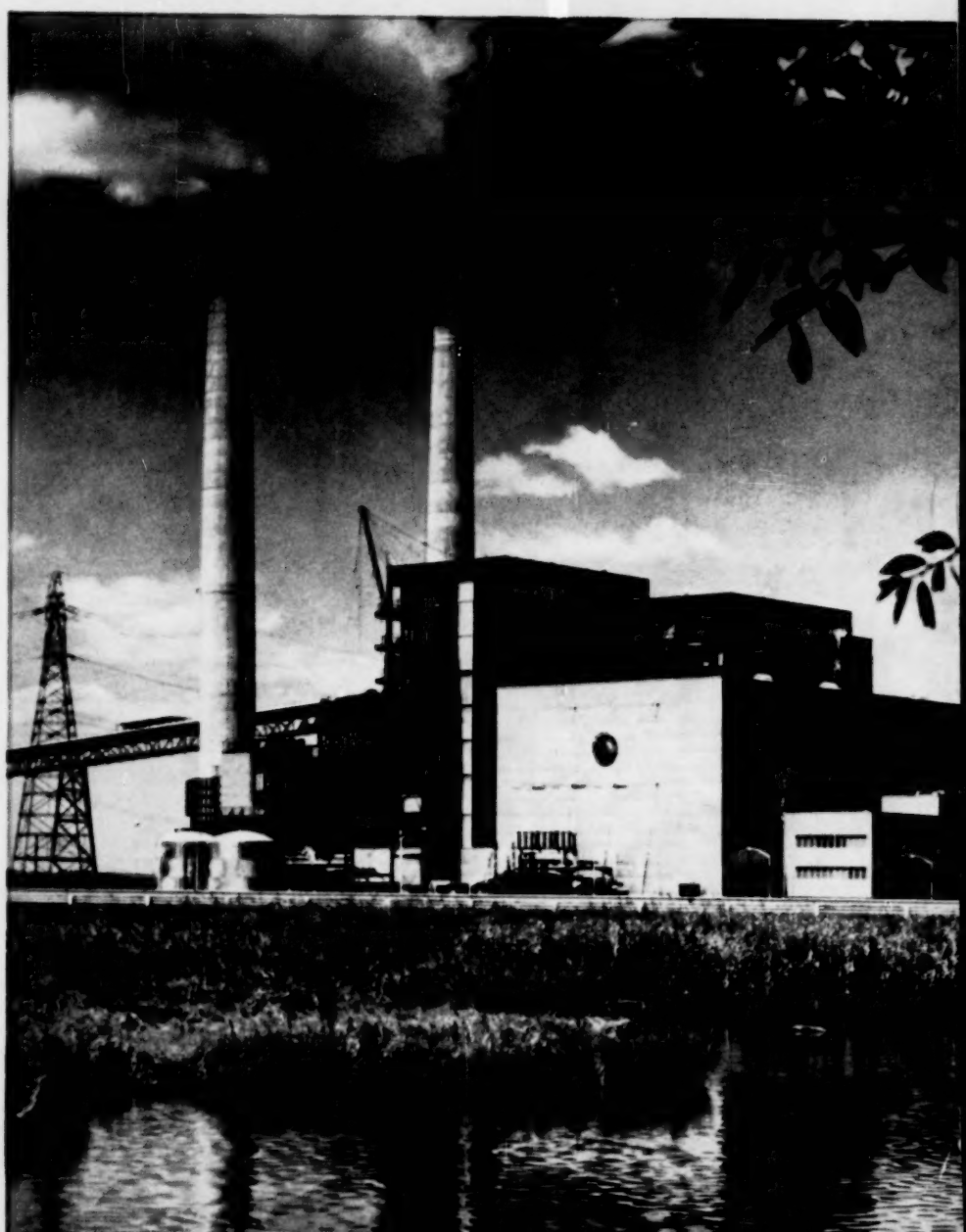
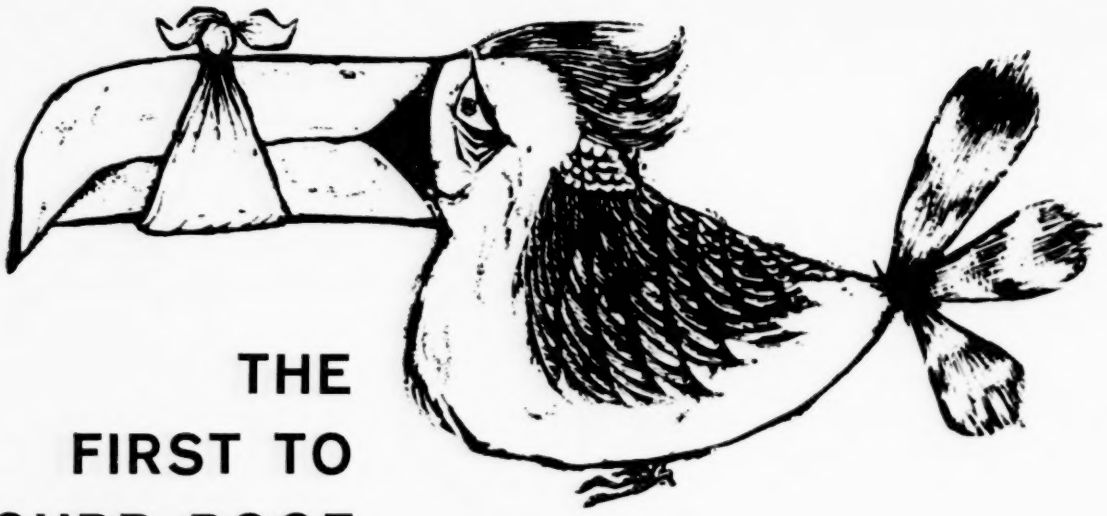
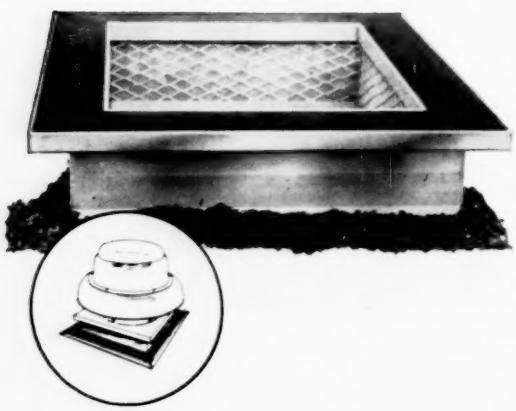


Eye-catching Bergen Generating Station, second largest in Public Service Electric and Gas Co. system, helps



THE FIRST TO CURB ROOF EXHAUSTER NOISES WERE ENGINEERS AT PENN!



Penn's SONOTROL CURB *for all roof ventilator installations provides* 3 IMPORTANT BENEFITS *to the Specifying Engineer*

Putting the curb on prevailing problems that accompany roof ventilator installations was no easy task. Roof fan sounds had to be hushed. Field constructed curbs were often haphazardly put together; they overloaded roofs and lacked dimensional coordination for ventilators and dampers. But, engineers working at Penn developed the industry's first solution . . . the *Sonotrol Curb!*

EXTRUDED ALUMINUM, an exclusive in Penn's Sonotrol design features structural "I" beam lifetime construction; reinforced seamless outside wall; loading capability of more than 700 lbs. per lineal ft. with a minimum safety factor of 2.5; provides stabilized dimensions for all dampers and ventilators . . . and everything fits!

ACOUSTICAL-THERMAL INSULATION reduces decible build-up of exhauster at the source; attenuates resonance and reverberation; minimizes sone values; no reduction in air movement.

SELF-FLASHING eliminates the problem of field flashing over the Curb; installation is simplified; flashing flange incorporates V-groove serrations for maximum gripping power.

Get complete facts now on how Penn Ventilator can be your one source for the universally accepted Sonotrol Curb, Damper and Ventilator. Contact your local representative or write direct.

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How Much Steam Should a Steam Trap Trap?

. . . some answers to commonly asked questions about the primary job of a steam trap

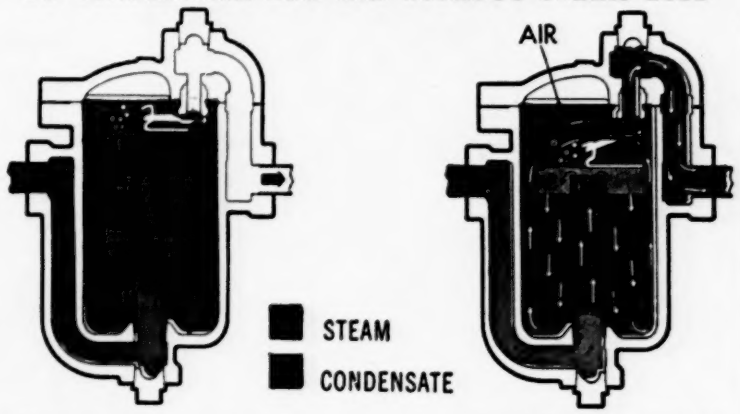
You don't need a doctor's degree in thermodynamics to answer the question at the top of this page. Naturally, a steam trap should trap *all* the steam.

Unfortunately for you, the problem isn't quite that simple. After all, a shut off valve would trap all the steam . . . and condensate, and air, and carbon dioxide as well.

So we'd better amend the answer to the question this way: A steam trap should trap *all* the steam but *must* remove condensate, air and carbon dioxide as rapidly as they accumulate.

With this established, let's take a closer look at what's involved:

HERE'S THE STEAM TRAP DESIGN THAT GETS RID OF CONDENSATE AND AIR WITHOUT STEAM LOSS



Trap open. Condensate entering trap has caused bucket to lose buoyancy. Weight of bucket times leverage pulls valve open. Air is discharged along with condensate.

Trap closed. Steam has floated inverted bucket; valve is held tightly closed by system pressure. Air entering trap passes through bucket vent and accumulates at top of trap.

A Steam Trap Should Trap All The Steam

If you've had experience with several different makes of traps, you already know that some trap steam better than others. The operating principle of the trap is what makes the difference. We like to talk about it because Armstrong traps are designed so that no steam can get to the orifice. The valve is always water sealed. Result: *More efficient steam utilization, lower fuel costs.*

A Steam Trap Should Remove Condensate

All traps remove condensate—after a fashion. For maximum efficiency in the unit being drained, though, the trick is to get it out without waiting for it to cool and without leaking steam.

Armstrong's water sealed valve takes care of steam leakage. The inverted bucket operating principle opens the trap for water regardless of its temperature. This means you get the condensate out as quickly as it accumulates. Result: *Higher temperatures and better heat transfer in steam heated units.*

A Steam Trap Should Remove Air and CO_2

Part and parcel of the condensate removal problem is removal of air as well as oxygen and carbon dioxide—two real troublemakers. Air tends to reduce operating temperatures and interfere with heat transfer. CO_2 goes into solution to form corrosive carbonic acid which, for example, can eat unit heater tubes. O_2 aggravates the situation. Believe it or not, but all traps don't properly remove air and CO_2.

By now, you've probably guessed that Armstrong traps *do* remove air and CO_2. Armstrong design (see illustration) provides continuous venting of air and CO_2. By opening suddenly, the Armstrong trap creates a momentary pressure drop to "pump" the air down to be vented. Result: *Higher temperatures, faster heat-up, better heat transfer and reduced corrosion.*

Note: When required, specially sized air vents are furnished. For fast heat-up of low pressure on-and-off units, Armstrong provides open float and thermostatic air vent traps.

What's the Final Answer?

Summing it all up, you'll get the best service from steam heated units that are equipped with traps designed to trap *all* the steam and remove air and condensate as quickly as it accumulates. In our prejudiced viewpoint, this means Armstrong traps. More important are the several thousand users of Armstrong traps who have proved the point.

Before you make up your mind, though, consider the minimum maintenance requirements of Armstrong traps . . . and the convenient assistance your local Armstrong Representative provides. These are important plus values.

Put Up or Shut Up

We're so confident that we "put up". Armstrong traps are unconditionally guaranteed to satisfy. So you can find out for yourself with practically no risk. If you're not completely satisfied with the way they do their job, you can get your money back.

* * *

The 44-page Armstrong Steam Trap book goes into greater detail on these and other Armstrong features. It also discusses trap selection, installation and maintenance. Ask your Armstrong Representative for a copy or write

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8463 Maple Street
Three Rivers, Michigan

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See our catalog in Sweet's Industrial Construction File

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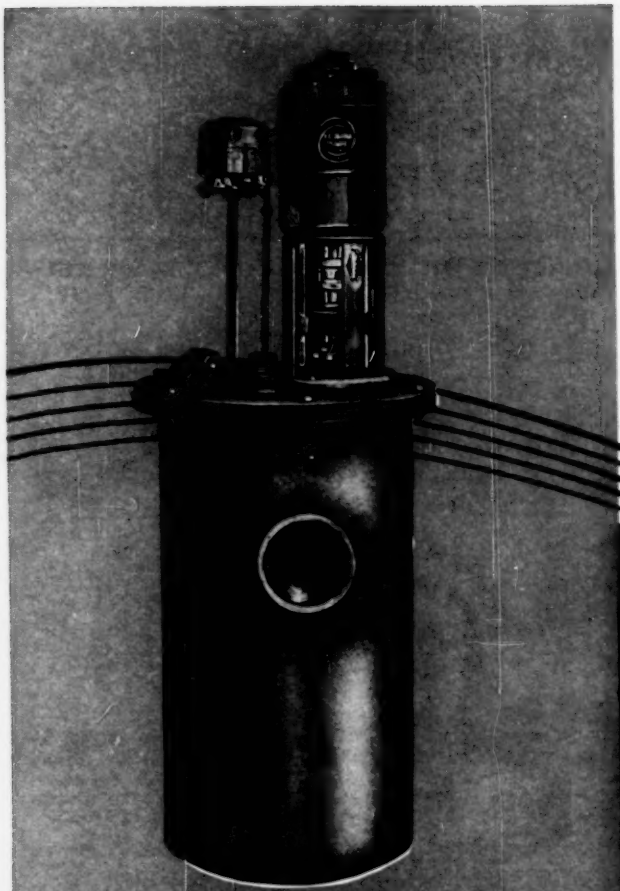

SKIDMORE SINGLE UNIT UV PUMP

SKIDMORE DUPLEX UNIT UV PUMP

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Type UV condensate pump is ideal for return of condensate to the boiler or other points. Built in both single and duplex units . . . type UV pump can be installed with cover plate flush with floor . . . motor and float switches are easily accessible above flood level and out of danger.

. . . write for complete Engineering data on all Skidmore Pumps or contact the Skidmore representative in your locality.

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Volume 57, Number 12 **December, 1960**

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AIR CONDITIONING, HEATING AND VENTILATING is published monthly by The Industrial Press, 93 Worth Street, New York 13, N. Y. Executive, editorial and subscription offices, 93 Worth Street, New York 13, N. Y. • Subscription rates: In the United States and Canada, one year, $5; in all other countries, one year, $12. Single copies, $1. • Copyright 1960, by The Industrial Press. Permission required to reproduce articles. • Contents of AIR CONDITIONING, HEATING AND VENTILATING are indexed monthly by Industrial Arts Index and microfilmed by University Microfilms, Ann Arbor, Mich. • Member: National Business Publications, Business Publications Audit of Circulation, Inc., Society of Business Magazine Editors. Accepted as controlled circulation publication at East Stroudsburg, Pa.

COVER PHOTO: At night, green floodlights give New Jersey's Turnpike travelers a most attractive view of new Bergen Generating Station, second largest in Public Service system. View by day, shown on cover, is still eye-catching as station stands hard by Overpeck Creek and dominates its surroundings. A brief pictorial report on **some interesting air conditioning, heating and ventilating systems** incorporated in the station constitutes about half of this month's **Picture Paragraphs,** page 60.

HIGH SPOTS in this issue

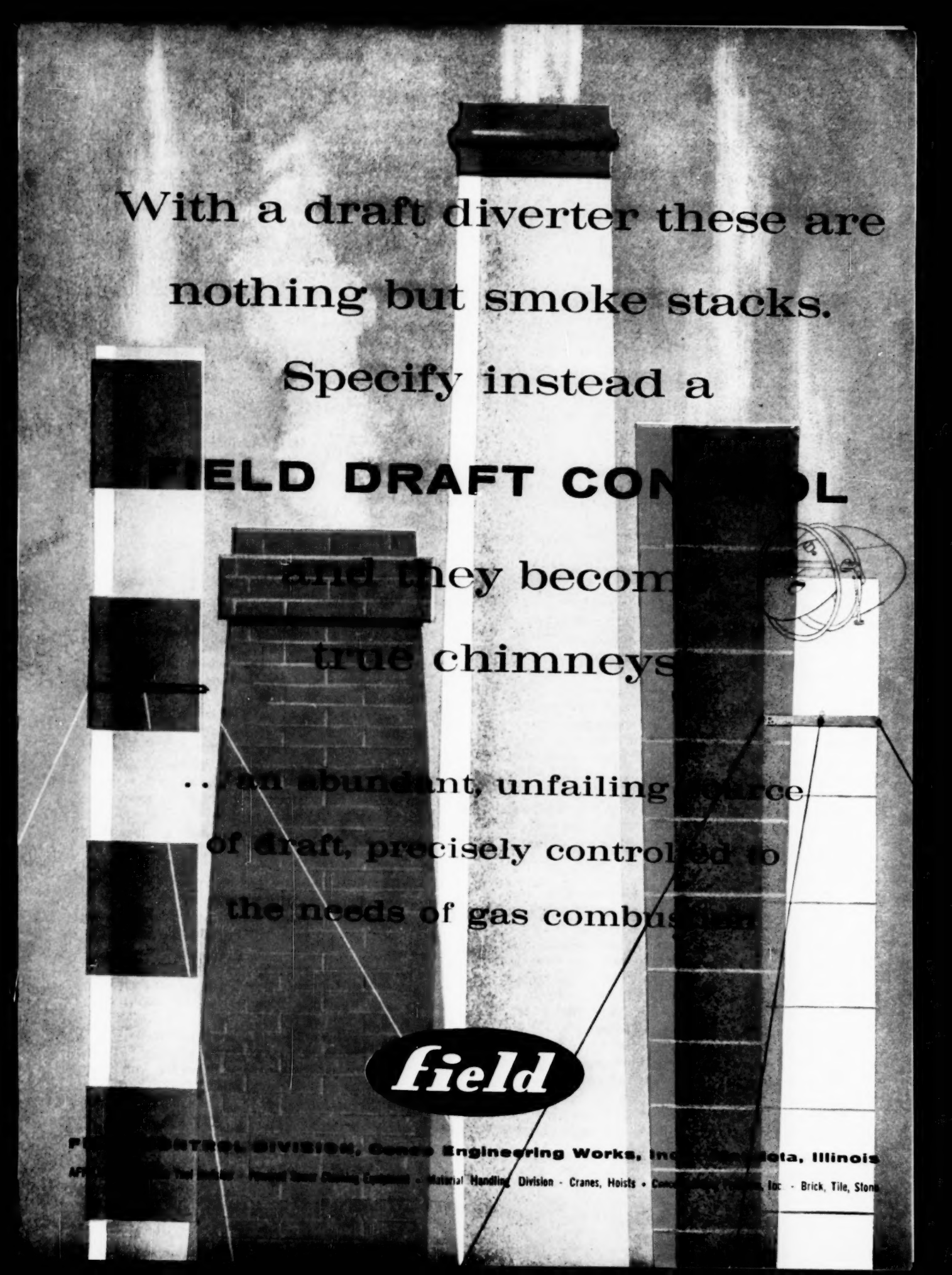
HYDRONIC HEATING: How to get the most out of hot water when **heating commercial and industrial structures** is the subject of this month's **Reference Section,** starting on page 67. Author Bob Emerick is well-known as both an engineer and writer of experience, and we are pleased to present a rather comprehensive review of hydronic design techniques he has found valuable in commercial and industrial heating jobs.

NEW MONTHLY FEATURE: Melvin A. Ramsey, Worthington's peripatetic trouble-shooting consultant in air conditioning and refrigeration, shows how systems should be designed to operate efficiently at low loads. Each month, Mr. Ramsey's *Specification and Design Seminar* will get down to brass tacks on some aspects of system design which he finds is giving engineers trouble. His comments are based on a career in the industry, as contractor, designer, consultant, teacher and writer that goes back to 1927 and is still going strong. See page 85.

INDUCED DRAFT FANS: In the process of selecting induced draft fans for thousands of conventional steel and cast iron heating boilers, it has been necessary to evolve fast, **simplified procedures that will result in adequate fan capacities,** with margin for unforeseen conditions but avoiding foolish excesses of capacity for both engineering and competitive reasons. So states Hal Reynolds on page 51 in introducing his article, "Selection of Induced Draft Fans for Heating Boilers".

NEW COOLING DATA: In response to an FHA demand that the residential air conditioning industry either agree on a **unified method for estimating cooling loads** or else the Government itself would have to step in, a special committee of ARI, I-B-R, and National Warm Air has come up with a simplified, uniform, and rational procedure. For a summary of the report from the University of Illinois, see page 54.

CONFERENCE REPORTS: Problems of importance to the consulting engineer in the conduct of his business were discussed at the semi-annual meeting of **Consulting Engineers Council.** One of three conference reports we are presenting this month, this recapitulation begins on page 95. Our **News of the Month** department, page 8, contains the other two: the 25th annual meeting of the **Industrial Hygiene Foundation of America, Inc.,** an association of industries coordinated by Mellon Institute for the advancement of healthful working conditions; and semi-annual meeting of **The Institute of Boiler and Radiator Manufacturers,** at which I-B-R members heard a progress report from the University of Illinois on summer operation of the valance system of year-round conditioning.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nothing but smoke stacks.
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What Readers Say:

Waste Heat Reclamation in British Laundries

EDITOR, AIR CONDITIONING, HEATING AND VENTILATING

About a year ago, a very interesting article in AIR CONDITIONING, HEATING AND VENTILATING showed full possibilities of waste heat reclamation for laundries.* This was based on U.S.A. laundry practice, and it seems rather rewarding to compare this with British laundry methods, which are basically different in many respects.

According to the information given, one-third of the steam used in a U.S.A. laundry is needed for drying and finishing and two-thirds for heating water, which apparently is practically the only source of heat in the washhouse. The latter is given as 4,612 lb steam for 1,200 lb dry work per hour; that is, 3.85 lb of 100 lb pressure steam per pound of work. This leaves 1.9 lb steam for drying and finishing and gives a total steam consumption of 5.75 lb per pound of work.

The figure of 1.9 lb for drying and finishing agrees perfectly with British targets and indicates that the methods used must be very similar indeed. The U.S.A. washhouse consumption of 3.85 lb, however, is very much higher than the British target of 1 lb steam, a little more or less, according to the processes and machines used. About half of the difference of 2.85 lb is caused by the general use of cold rinsing in Great Britain. This was originally developed by the B.L.R.A. (British Launderers' Research Association) but has proved so successful that it is now not only fully accepted in Great Britain, but is increasingly used in Holland, Germany and other parts of Europe.

The other half of the difference derives from the fact that hot water is very little used in British Laundries. Water is heated by live steam injection in the wash wheels to the temperature actually required. This keeps waste to a minimum, obviates the losses in the storage heater, and greatly reduces the heat losses from the pipe system. This can be very high even with very good lagging, especially where a circulation system is used. The amount of steam thus saved is more than the British washhouse consumption, or about the same as the amount which can be saved by a heat reclaimer in the U.S.A. system.

Open pit heat reclamation is very little used in British laundries, but the closed system is becoming more and more popular. In a system of synchronized wash wheels, cold water coming from the last rinses is heated by the hot soiled liquor from the washes, and the first rinse in a plate-type heat exchanger; this forms an integral part of the unit and is easy to clean. As the wheels are synchronized, very little water has to be stored. A typical steam consumption is 0.6 lb per pound dry work, compared with the 2.2 lb given for U.S.A. laundries with heat reclamation. In addition, the water consumption is reduced to about half.

In another widely used system, the heat exchanger is done away with. Reclamation is achieved by the simple expedient of re-utilizing the same liquor consecutively in a number of synchronized wash wheels. Fresh water enters the machine performing the last rinse, the effluent of which goes to the intermediate, and after that to the first rinse machine. The effluent from this, already enriched in heat, detergents and of course soil, goes to the last suds machine where only a small addition of steam and detergents is needed to bring it to full washing efficiency. By the time the heavily soiled liquor leaves the machine performing the breakwash, it is fairly cool and contains only little free detergent. The heat (and water) consumption of this process is about the same as that of the reclamation process mentioned.

With a washhouse consumption of only 0.6 lb steam per pound of work, and a finishing consumption of 1.9 lb, the relation between the two departments is just the reverse of what it is in U.S.A. As the condensate from the finishing machines is generally recovered for boiler feed, only little make-up water is required for the boiler, often less than is needed to cool the condensate to a temperature which can be handled by the feed pumps. Flash steam recovery becomes thus almost a necessity but is handled in a very different way than in U.S.A. laundries.

The British method uses little hot water, and none at all in the recovery systems. On the other hand, the live steam for the wash wheels may be at a very low pressure. The condensate from the finishing section is therefore taken to a vessel where its pressure is reduced from approximately 100 to approximately 10 lb and the resulting flash steam is fed into the washing machines. With the low steam consumption of a recovery type washhouse, the flash steam available from the finishing department condensate may represent a significant proportion of the washhouse requirements.

As there is very little demand for hot water, very little use can be made of engine exhaust. On the other hand, unless the exhaust heat can be usefully applied for process requirements, the high fuel cost of small steam engines makes them prohibitive for power production, even if the engine is already written off completely. Only few British laundries still produce their own power, and going over to grid electricity has always resulted in a reduction of the total bill. Even the use of inlet pressures so high that the exhaust pressure would be sufficient for the finishing departments would not pay; although the problem has often been discussed, no plant on this principle has been built so far. In modern laundries it has even become difficult to find an application for the exhaust from the boiler feed pumps which, in spite of their simplicity and reliability, are increasingly replaced by ones with electric drive.

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H. A. Blum

British Launderers' Research Association, Hendon, England

* "Waste Heat Reclamation for Laundries," J. J. Coleman, Oct. 1959, 85-86.

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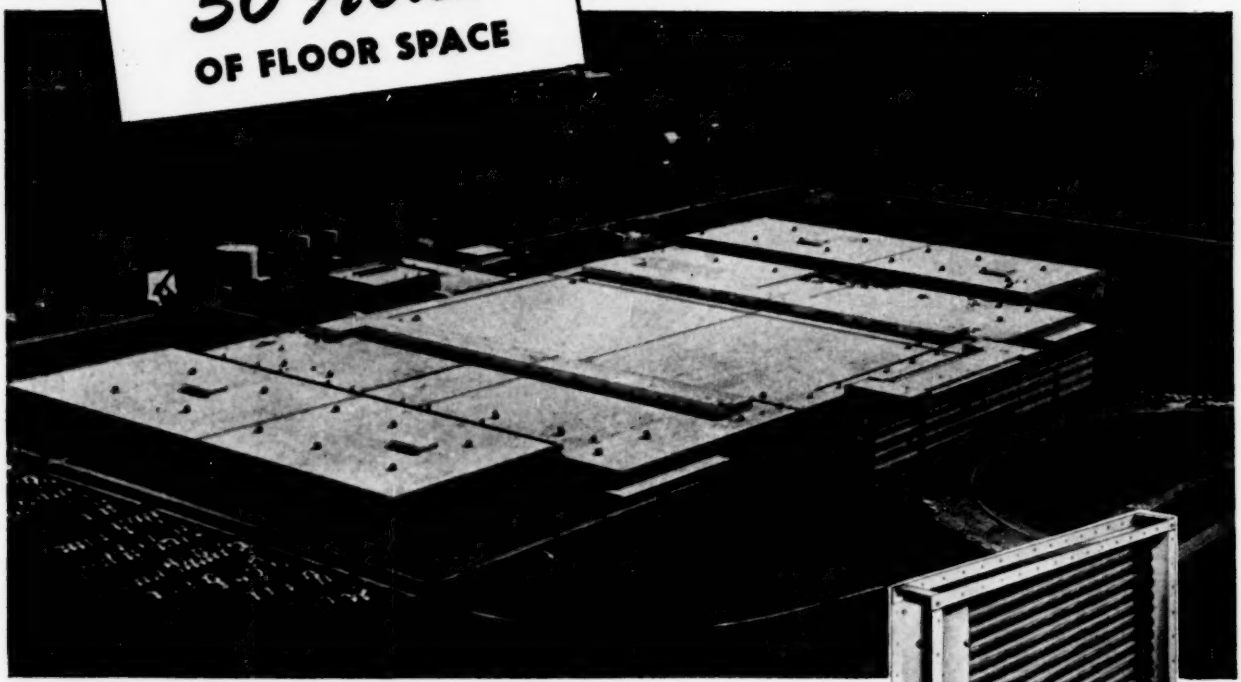

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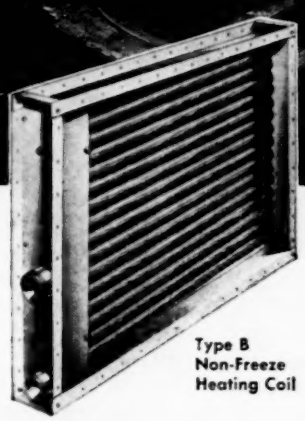

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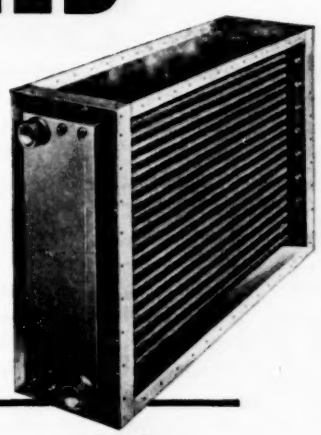

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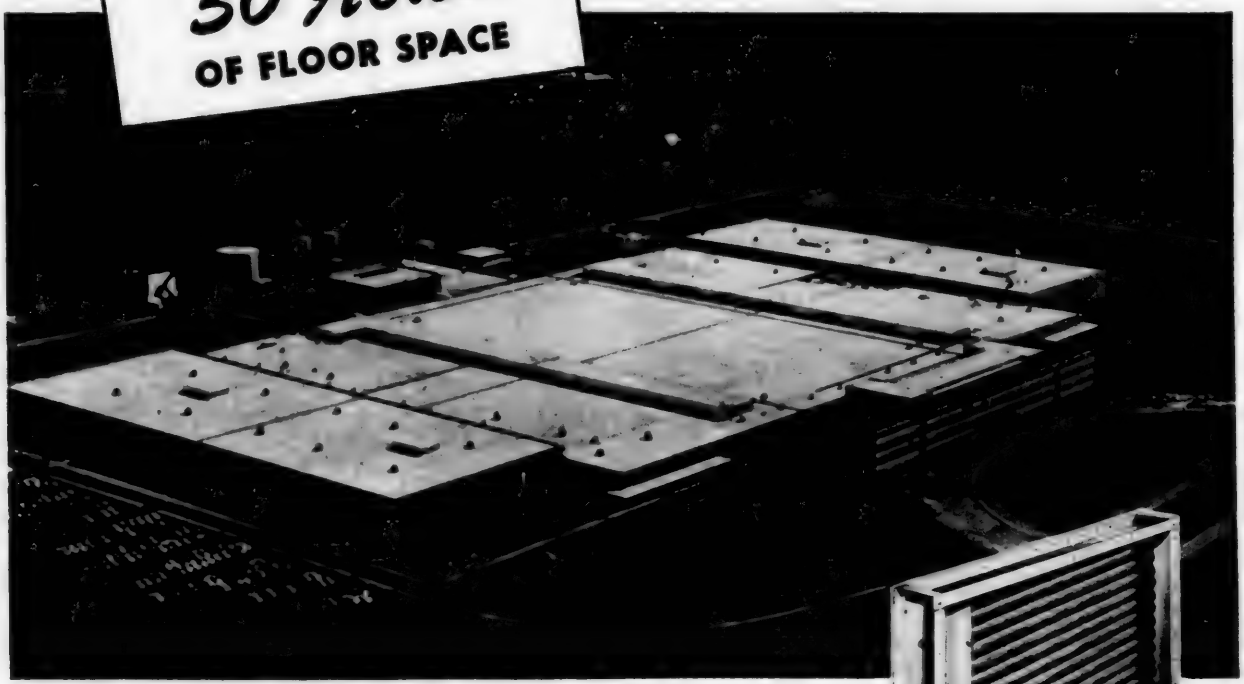

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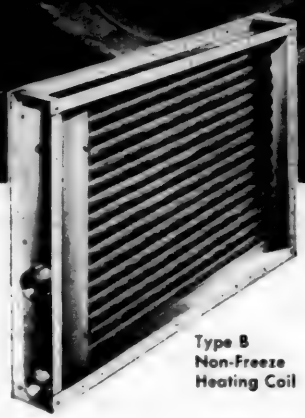

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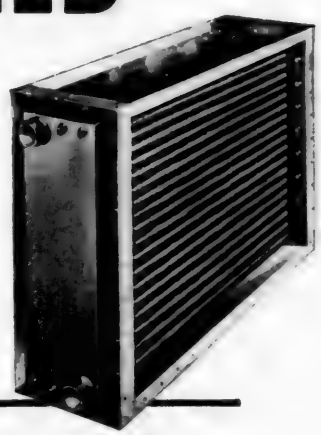

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ENGINEERING OFFICES IN PRINCIPAL CITIES

Cleaner Air, Indoors and Out, Advanced at Industrial Hygiene Foundation Meeting

Hundreds of engineers, toxicologists, doctors, and industrial hygiene technicians converged on the Mellon Institute in Pittsburgh October 26 and 27 for the 25th Annual Meeting of the Industrial Hygiene Foundation of America, Inc., an association of industries coordinated by the Institute for the advancement of healthful working conditions.

Following welcoming remarks by Dr. G. H. Young, director of research of the Mellon Institute, the many research activities and related services performed by the Industrial Hygiene Foundation were dramatically set forth in an address by Dr. H. H. Schrenk, managing director of the Foundation.

In his talk, entitled "Foundation Facts," Dr. Schrenk pointed to an increase in Foundation activity during the past year on five major fronts: (1) Technical information services, (2) consultation services, (3) in-plant hygienic surveys and outdoor air pollution studies, (4) investigations of particular toxicological, technical, and control situations, and (5) training of industrial hygienists for their increasingly important role in industry.

The Foundation laboratory last year investigated the toxicity of some eighteen organic compounds increasingly found in industry. About a third of these studies were major long term efforts, two of which are integrated with a broad program of investigation into the effects on human lungs of chronic exposure to various substances. Nine technical papers were written covering silicosis, toxicity of dusts, and cyanamides.

Some 1200 abstracts of related papers were prepared and circulated in response to more than 30,000 inquiries. New activities in training industrial hygienists included a training course which has graduated twelve qualified professional technicians. This program is expected to increase in importance in the future.

Dr. Schrenk detailed new gains for Foundation on five major fronts.

Theme of other papers in the opening conference was: Group insurance — a mounting production cost. A. T. Klassen, vice president, industrial relations department, American Can Company, pointed out that investment in medical care provisions by industry mounted from $952 million in 1950 to $4.164 billion in 1959. Part of that increase was attributed to the increase in the number of people covered; another significant part resulted from inflation and wasteful practice. Mr. Klassen said the average cost per person of these programs had increased 45% in ten years — more than the increase of any other factor comprising the consumer cost index.

It is not realistic, said Mr. Klassen, to expect management to keep putting money into these programs without making some attempt to bring the ordinary economic concerns of management to bear upon them. Mr. Klassen suggested a five-point program of action to control the mounting costs of medical benefit plans; (1) Seek improvement in the administration of benefit plans, being sure that claims are paid promptly but that false claims are adequately policed. (2) Encourage insurance carriers to improve their management. (3) Carry the public relations effort to the community level, letting doctors know that we are concerned about mounting costs. (4) Tell employees what is involved, that is, let them realize that the cost of any medical plan must be a part of wages, whether paid directly or not. The cost can be paid only by the productivity of wage earners. (5) Unions must be helped to realize that more dollars given to benefit costs mean less take-home pay for members.

R. R. Shinn, second vice president, group insurance, Metropolitan Life Insurance Company, pointed out that publicity on abuses of group insurance plans has not been balanced by accurate information regarding the actual performance of both physicians and employees under these plans. Actual abuses are a small per cent of the rising cost of medical plans. Payments for services have been higher, accident and health insurance terms improved and payments to an increasing number of retired employees also tend to raise costs. There are two major factors in cost increase, according to Mr. Shinn. (1) General inflation, including standards of coverage. (2) Increased concern in the United States over health. We should be careful in assessing where quality reaches a limit and over-concern begins.

Dr. J. F. McCahan, medical director, Hawthorne Works, Western Electric Company, gave some pointers on how sickness absenteeism

(Continued on page 10)

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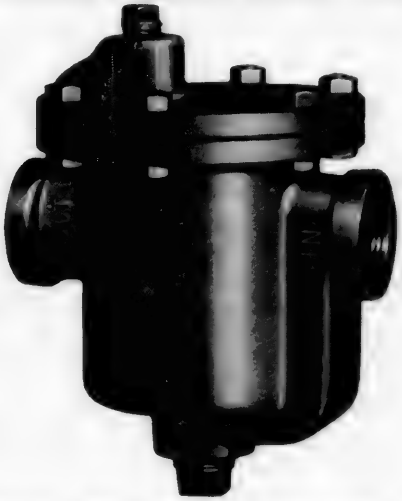

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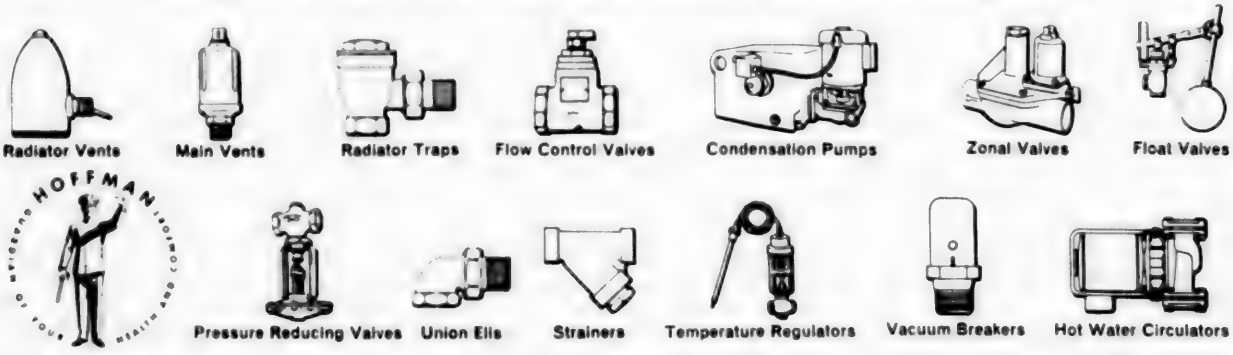

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VALVES • TRAPS • PUMPS • STRAINERS • REGULATORS

I-B-R Hears Valance System Design Report; Cooling Performance Is Rated "Very Good"

Professor Warren S. Harris, at the I-B-R semi-annual meeting (Absecon, N. J., Nov. 1-3), presented a progress report describing the results of tests obtained on an experimental valance system in the I-B-R Hydronic Research House during the summer of 1960. The I-B-R Research House is a tri-level house which was built in 1959 at Urbana, Ill., by the Institute. It is a fully instrumented "field" laboratory in which hydronic heating and cooling equipment performance may be studied under actual operating conditions. Studies in this house are made under the terms of a cooperative research agreement with the University of Illinois. Professor Harris has been in charge of the I-B-R research program since its inception in 1940.

The valance system studied is one designed to heat the home with hot water in cold weather, and to cool it with chilled water in hot weather. The same valance units are used for both the heating and cooling cycles. The units are located along the outside walls of the rooms near the ceiling level. All air circulation, both summer and winter, is by gravity. The valance installation was a three-zone system with all units on each zone series connected. One zone served each level of the house.

Thus far, only the cooling tests have been made. The control system used during these tests consisted of a thermostat in each zone which controlled the operation of the zone valve. As long as any zone required cooling, the circulating pump was in operation and the chiller operated to maintain a chilled water temperature of approximately 40 deg F.

Whenever the same unit is used to both heat and cool a room, one is faced with the problem of deciding whether to select the unit on the basis of the calculated heating load, calculated cooling load, or some combination of these two calculated loads. In selecting the valance units for the I-B-R Hydronic Research House, the following procedure was followed:

1. Both design heating and design cooling loads were calculated for each room using I-B-R Guides H-20 and C-30 respectively.

2. The length of wall available for the location of valance units was determined for each room.

3. The room having the highest calculated heat loss per foot of available wall (Step 2) was determined. In this case it was found to be the living-dining area.

4. Using a chilled water temperature of 40 deg, the length of valance assembly required to provide cooling equal to the calculated design cooling load of the room determined in Step 3 was determined. In this case it was found that using all the available wall space, only 90% of the calculated cooling load could be taken care of.

5. Using the length of valance assembly determined in Step 4, an average water temperature was determined which would result in a heating output of the installed radiation equal to the calculated design heating load of the room. This was then used as the design water temperature for the entire system. In this case the water temperature was found to be 180 deg.

6. Using the design water temperature determined in Step 5, the length of valance assembly required in each room of the house to satisfy the design heating load was determined. This provided a system which, according to calculated loads, would be in proper balance during the winter months.

7. Using a design water temperature of 40 deg, the cooling capacity of the valance assemblies selected in Step 6 were determined and compared with the calculated design cooling loads.

This method of design resulted in the selection of valance assembly lengths such that the system should be in *proper* balance in the winter and in *approximate* balance during the summer.

The tests were designed to indicate the effectiveness of the valance system in producing a comfortable cooling environment in a residence. The evaluation of the valance system for cooling made by the research staff was based on a scale of:

1 = excellent
2 = good
3 = satisfactory
4 = poor
5 = unsatisfactory

The staff rated the valance system as follows:

Performance = 1.7, very good

Installation and design = 3.2, acceptable but room for improvement.

Winter performance is now being observed and will be reported to The Institute at their annual meeting next June.

INDUSTRIAL HYGIENE MEETING

(Continued from page 8)

can be controlled. Where absenteeism is not carefully monitored it increases, said Dr. McCahan. The program at Western Electric includes careful selection of job applicants with respect to emotional and physical stability, indoctrination of new employees with the responsibility of their jobs, enlistment of surveillance by line supervisors including calling absent employees at home, home visits by nurses, careful records examined periodically.

The afternoon management conference included a panel discussion on the effects of food additives legislation on food technology. This was followed by a discussion of standards for air quality by V. G. MacKenzie, chief, Division of Air Pollution, USPHS.

We must approach the setting of air standards with caution, said Mr. McKenzie. Insofar as possible the setting of standards should be kept within the realm of informal consensus of scientific opinion before standards are established as law. Statutory standards tend to immobilize action which may be needed for future development.

Methods of sampling, Mr. McKenzie pointed out, should be professionally standardized as should other techniques to promote unified reporting of results. It should be

(Continued on page 12)

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Let North winds blow, Summer sun glow —Buensod Dual-Duct affords complete conditioning through all the seasons of the year, heating and cooling, always maintaining proper conditions in every space. And this Buensod-pioneered "all-air" system, with patented automatic volume-controlled mixing units, provides constant air volume in every zone, regardless of variance in static pressures. That means the installation cannot be thrown out of balance, ever. Learn why Dual-Duct is the logical choice for new and renovated structures alike. Write for Bulletin DD-6 or contact your local Buensod representative and get complete details.

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One group of speakers at Industrial Hygiene Foundation Engineering Conference: left to right, Dr. R. O. McCaldin, U. S. Public Health Service; K. J. Caplan, Mallinckrodt Chemical Works; Dr. A. D. Brandt (chairman), Bethlehem Steel Co.; G. A. Howell and Dr. C. A. Bishop, both of U. S. Steel Corp.; and W. T. Ingram, American Society of Civil Engineers.

INDUSTRIAL HYGIENE MEETING

(Continued from page 10)

borne in mind, however, that standards of emission and ambient air quality will differ from one community to another, owing to differences in population density, meteorology, elevation, etc. Efforts at quantitative analysis like the Los Angeles Program are needed in other metropolitan areas.

Engineering Sessions

The second day of the meeting found delegates assembled in concurrent sessions of papers on their various specialties. There were separate medical, legal, engineering and toxicological conferences. Of immediate interest to ventilation engineers was the engineering conference under joint chairmanship of A. D. Brandt, Bethlehem Steel Company, and L. V. Cralley, Aluminum Company of America.

R. O. McCaldin, of U. S. Public Health Service, spoke on acceptable equipment and procedures for evaluating air pollution problems. There is an increasing number of instruments for air sampling. More than sixty such instruments have become available during the past four years. Some of the more widely used devices include high volume samplers, filter tape samplers, gas samplers and simplified monitoring devices which require little maintenance for fairly long sampling periods. These instruments and the techniques and limitations of their use are reported in a 1960 publication, "Air Sampling Instruments for Evaluation of Atmospheric Contaminants," an up-dated edition of the Encyclopedia of Instrumentation for Industrial Hygiene published by the University of Michigan in 1956. The new edition is available through the American Conference of Governmental Industrial Hygienists, 1014 Broadway, Cincinnati, Ohio.

W. T. Ingram, chairman of the Committee on Atmospheric pollution, Sanitary Engineering Division, American Society of Civil Engineers, gave a talk on environmental performance standards and

(Continued on page 14)

CELL GENERATES ELECTRICITY FROM GAS, WATER AND AIR

A completely gas-operated fuel cell power pack that will generate electricity directly from natural gas, water and air, is under development at the Institute of Gas Technology, an affiliate of Illinois Institute of Technology, Chicago, Ill. This research on fuel cells for domestic use is being sponsored by the American Gas Association.

Construction of a prototype fuel cell battery will begin in 1961. An experimental 6-cell natural gas battery was operated for the members and trustees of the Institute at their annual meeting. The 2-watt unit was built primarily to test novel cell components, and to demonstrate the feasibility of using natural gas.

According to Dr. M. A. Elliott, director of the Institute, a natural gas fuel cell power pack producing about 10 kw probably will be no larger than a gas furnace. The heart of such a unit will be a number of thin, high-temperature cells, generating electricity by a direct electrochemical reaction.

ARTHUR CUTTS WILLARD FUND ESTABLISHED AS A MEMORIAL

At the insistence of his many former students, friends, and associates, an Arthur Cutts Willard Lectureship and Student Grant Fund is being established in memory of the former president of the University of Illinois. Dr. Willard, one of the nation's leading air conditioning, heating and ventilating engineers, passed away in September of this year.

Dr. Roger Adams, research professor of organic chemistry, emeritus, and former head of the Department of Chemistry of the University of Illinois, is chairman of a committee which has been organized for this purpose.

Persons wishing to contribute to this memorial may do so through the University of Illinois Foundation, Room 224 Illini Union, Urbana, Ill. Such contributions are tax deductible, the committee states.

Low Water Cut-offs on Hot Water Boilers?!

...the industry has given the answer

Yes, the answer has come from the field . . . from the engineers, contractors and manufacturers. They have seen the logic of installing a water level control on hot water space heating boilers . . . a low water cut-off, or—for even greater precaution—a feeder cut-off combination.

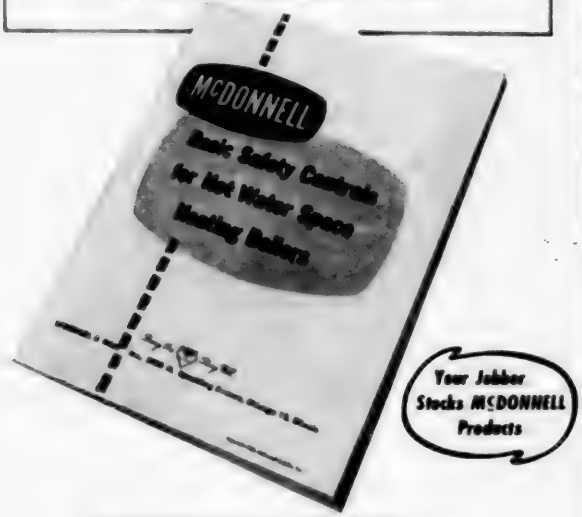
We knew it was a good idea. Expected it to grow and grow. But frankly we have been surprised at how rapidly the heating industry has taken hold of water level control as a logical team mate for an ASME pressure relief valve.

In fact, many local codes now require a low water cut-off, or feeder cut-off combination, on hot water boilers installed in places of public occupancy—including multiple dwelling units.

Notice the diagrams of recommended installations opposite. For more detailed discussion get this booklet that tells the whole story: "Basic Safety Controls for Hot Water Space Heating Boilers."

The What-Why-How in eight interesting pages

Write for Bulletin P-30C



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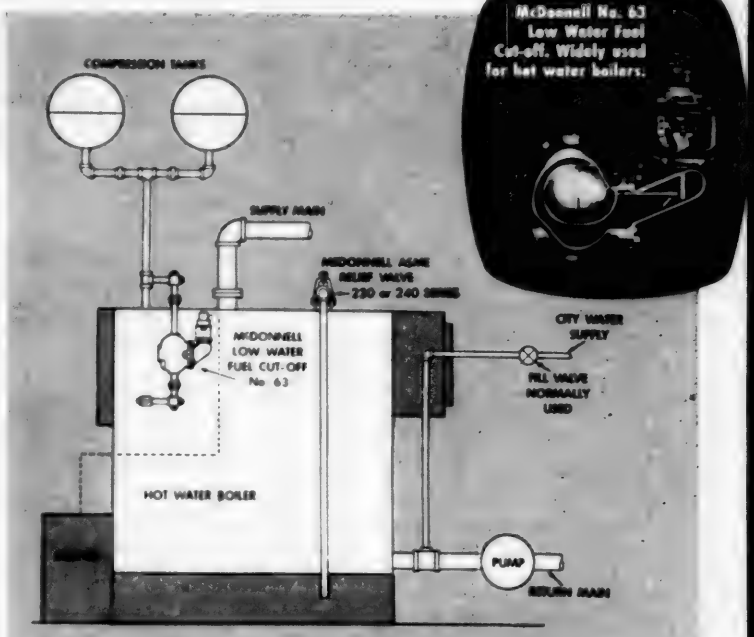
McDonnell No. 63 Low Water Fuel Cut-off. Widely used for hot water boilers.
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SUPPLY MAIN
McDONNELL ASME RELIEF VALVE — 230 or 240 SERIES
McDONNELL LOW WATER FUEL CUT-OFF No. 63
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FILL VALVE NORMALLY USED
HOT WATER BOILER
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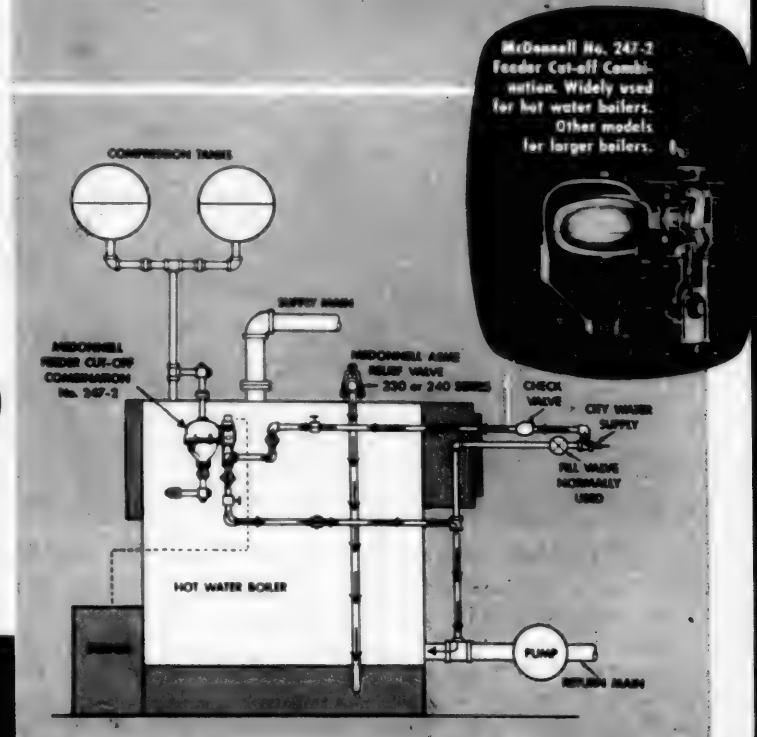
1 The essential low water control for a hot water boiler. A McDonnell Low Water Cut-off located above lowest permissable water level; also McDonnell A.S.M.E. Pressure Relief Valve.


McDonnell No. 247-2 Feeder Cut-off Combination. Widely used for hot water boilers. Other models for larger boilers.
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McDONNELL FEEDER CUT-OFF COMBINATION No. 247-2
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CHECK VALVE
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FILL VALVE NORMALLY USED
HOT WATER BOILER
PUMP
RETURN MAIN

2 The safest and most complete control for a hot water boiler. Offers a combination of mechanical and electrical safeguards which is today's best and most complete answer. A McDonnell combination Boiler Water Feeder and Low Water Cut-off; also McDonnell A.S.M.E. Pressure Relief Valve.

INDUSTRIAL HYGIENE MEETING

(Continued from page 12)

their place in planning and zoning regulations. Mr. Ingram warned that standards applied "after the fact" of an air pollution problem are not always effective. Frequently, limits on permissible amounts of effluent are applied without relation to a realistic estimate of present feasibility or future community development. Standards of general pollution levels similar to those now applied to water systems might be a desirable objective, but our present knowledge of air pollution is not sufficiently developed to make them effective.

Standards suitable for one community are not necessarily applicable to others. Mr. Ingram pointed to the administrative and meteorological differences affecting the programs for developing standards for Newark Airport, a three-state problem, as against problems in Detroit or Reno. It is extremely dangerous, said Mr. Ingram, to set specific numbers on effluent limits in zoning regulations. Standards should be the province of enforcing rather than that of the zoning authorities.

Benefits of central gas cleaning facilities were discussed by C. A. Bishop and G. A. Howell, both of U. S. Steel Corporation. Factors of economy and overall production efficiency were cited in a detailed account of central gas cleaning for production activities of U. S. Steel. Experience with individual cleaners at Fairless Works led to design and installation of a central system designed to handle a total volume of 585,000 standard cfm. The system proved efficient and greatly simplified problems of handling the total dust load and the intermittent character of steel furnace operation. Advantages in most cases far outweigh the disadvantages of central gas cleaning and it is believed that central systems will become more popular in the steel industry and elsewhere.

A paper on how to achieve better operation of dust control systems was presented by Knowlton J. Caplan, Uranium Division, Mallinckrodt Chemical Works. Mr. Caplan's paper is summarized in detail following this report.

Other papers offered to the engineering conference included a discussion of recent welding practices in naval facilities by C. P. Bergtholdt. For portable exhaust on welding jobs, a Navy standard has been placed at 375 cfm for each weldor or burner where the exhaust duct is brought within one foot of the torch. When welding or cutting metals backed by foamed-in-place plastic, workers should wear air supplied respirators and should be provided with exhaust ventilation of at least 1000 cfm discharging outside through a six-inch hose positioned as close to the work as possible (about eight inches).

Legal considerations involved in developing precautionary labels were discussed by J. D. Kittleton of the Manufacturing Chemists Association; and a progress report on in-plant hazard identification systems was given by J. J. Duggan of Union Carbide Chemicals Corp.

The engineering conference concluded with several short talks on recent developments in industrial hygiene. These covered: The plasma jet by H. W. Speicher of Westinghouse. Jets are used in metal spraying and require local exhaust and ear plugs for operator protection. Another short talk by R. H. Blackmer of General Electric assured delegates that the fuel cell, an electro-chemical energy converter, presents no serious hygiene problems other than ordinary safety precautions in handling hydrogen. N. G. White of Shell Chemical Corp. spoke briefly about new epoxy resins to which some workers develop

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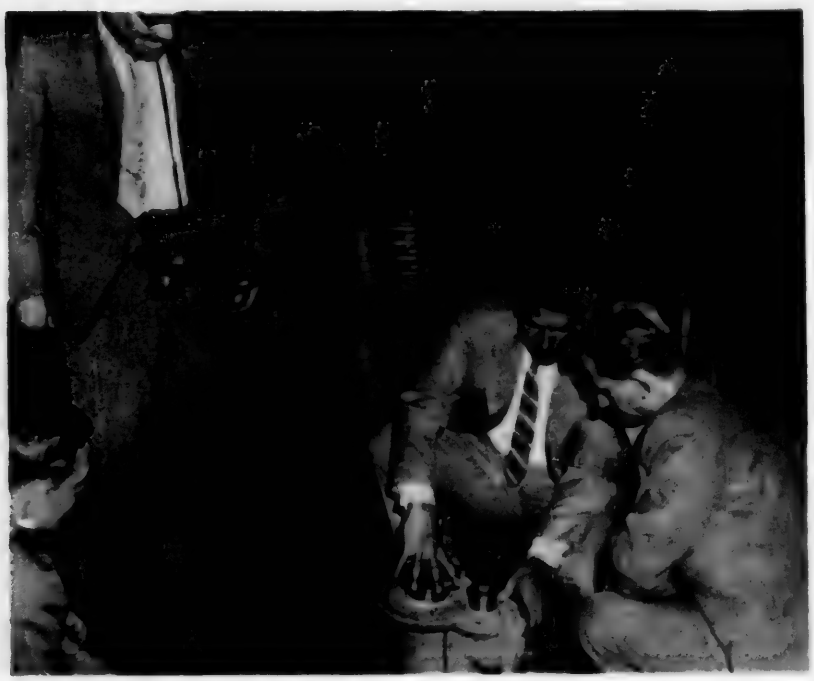

EUROPEAN SANITARY ENGINEERS IMPRESSED BY U.S. PRODUCTS

Sanitary engineers from Germany, Switzerland, and Italy, on an eighteen-day tour of the United States, were impressed by the fact that American manufacturers design so many products to do a specific job, and in doing so make many more types and variations of products than are made in Europe. Above, General Manager Bob Salsbury, Jay R. Smith Mfg. Co., Union, N. J., demonstrates a drain, with integral trap and cleanout, during a tour of the company. In designing and installing a plumbing system in Europe, these engineers have to specify drain, trap, and cleanout as three separate units, each of which would have to be separately fabricated into the installation.

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Sporlan *Catch-All*... the first molded porous core filter drier... Sporlan's amazing *See-All* the first combination moisture and liquid indicator... Sporlan Solenoid Valves with the layer wound Blue Seal Coil... Sporlan Thermostatic Expansion Valves with the original *FLOW MASTER* element and Refrigerant Distributors with the versatile interchangeable nozzle...

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INDUSTRIAL HYGIENE MEETING

(Continued from page 14)

sensitivity and allergic reactions. Some recent applications of glass cloth collectors for high temperature gas cleaning were described by R. J. Wright of American Air Filter Co. and R. T. Pring, Dracco Division of Fuller Co. Mr. Wright told how filter bags are cleaned during operation by gentle collapse and slow reinflation of the bags. Mr. Pring described how glass fiber bags can also be cleaned by low frequency sound waves. He showed large installations in cement kilns and copper converters where 8-inch diameter bags as long as 75 ft were cleaned by this method.

How to Impove Operation of Dust Control Systems

Knowlton J. Caplan, Mallinckrodt Chemical Works, told delegates to the engineering conference at the Industrial Hygiene Foundation how careful design and knowledge of some tricks of the trade can help improve operation of dust control systems.

Many of the results of installing a dust control system are intangible benefits to the health and productivity of plant environments, said Mr. Caplan. The return on capital investment for dust control is therefore difficult to itemize. For these reasons the costing tools of management in assessing the value of dust control systems should be supplemented by the audit of specialists such as industrial hygiene, safety, or medical departments. Any successful dust control program must be predicated on the willingness of management to foot the bill.

Better operation starts with better design, attention to detail, planning for easy maintenance. Once completed a system should be tested and operators instructed in its purposes and care. After that only consistent informed operation and maintenance are needed.

Design should follow any general standards of professional groups who have concerned themselves with dust control over the years. Such groups as ASA, ACGIH, AFS, NFPA, etc., have promulgated codes and data covering basic design. Mr. Caplan's discussion covers aspects beyond the scope of such codes.

Adequate transport velocities (3000 to 5500 fpm), although criticized as wasteful by some, err on the right side, if at all, practically speaking. Experience shows that it is better to reduce power requirements by streamlining the system than by cutting velocities. This avoids drop-out and accidental plugging in the ordinary course of variable operation of actual systems.

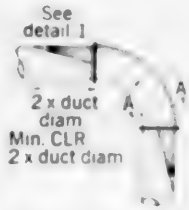
To handle oxides and salts of uranium, for instance, Mr. Caplan said, we originally designed to 4000 fpm with never any trouble from plugging—although some erosion of elbows at heavy dust loads did occur. Progressively lowering design velocities to 3600, 3000, and 2500 fpm we had no trouble, occasional trouble, and frequent difficulty, respectively. But even at 2500 fpm there was no trouble when all parts of the system were operating properly. The lower velocity system simply lacked reserves for the occasional operating stress that is bound to occur in practice.

Although branch velocities, especially to tight enclosures, are difficult to predict, transport can be assured if branches can be run essentially vertical. If this is not practical, a barometric damper or other bleed-in device helps maintain adequate velocity in the branch.

Sheet metal gages for duct work as specified in many standards are minimum gages. In practical situations it is frequently of advantage to specify heavier gages which prevent troubles from weak structure and usually require less maintenance than the so-called standard gages. We have found, Mr. Caplan said, that the use of 14-gage carbon steel and 16-gage stainless have proved economical because they can be field welded in any position and are less subject to external damage such as frequently occurs in actual installations.

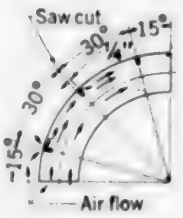
Similarly, the use of bolted flanges at dust joints serves to strengthen the structure and facilitate replacement should it become necessary.

Excessive erosion is seldom a problem where dust particles are small and duct work well designed. Erosion can occur, however, at blast gates. Therefore, it is well to design a balanced system with minimum reliance on blast gates. Erosion at elbows can be corrected by use of a flat-back elbow with replaceable sheet metal or rubber wall on the flat outside radius (Fig. 1). For handling sticky dust, special slotted elbows which induce a turbulent film of clean air bled in on the outside radius (Fig. 2) maintain separation of sticky dust from the surface of the elbow. For mod-



◀ Fig. 1

▼ Fig. 2



erately sticky dust proper design does not necessarily include clean-out doors, but these should be provided for very sticky dust, as from buffing operations.

Provisions for testing and inspetion should be built in for quick, simple, low-cost operation. For instance, a 2-inch iron pipe nipple with cap, installed conveniently on a duct, allows access for quick flow check or air sampling.

Commercial devices for permanent installation for flow measurement are valuable and should be used if frequent inspection is intended, Mr. Caplan said. A permanent manometer across a dust collector is a must. Often, in critical or complex installations, a pressure recorder is justified.

Locate equipment for ready access and inspection. Make allowances beforehand for checking on

(Continued on page 122)

Shirley Park Apartments, Arlington, Va.

"AS IF BY MAGIC, AIR TROUBLES VANISHED"

writes user of B&G Airtrol System

Circles enclose the B&G Airtrol Tank Fitting and Boiler Fitting.

Mr. Daniel C. Long

"Mr. Edwin B. Tidd,
Mgr. of Field Research,
Bell & Gossett Company

"Dear Mr. Tidd:

"We have been plagued by air in the top floor radiators throughout the projects we manage. Bleeding relieved the condition temporarily, automatic vents helped in some cases; however, complaints continued to pour in and our engineers worked around the clock without being able to correct the condition.

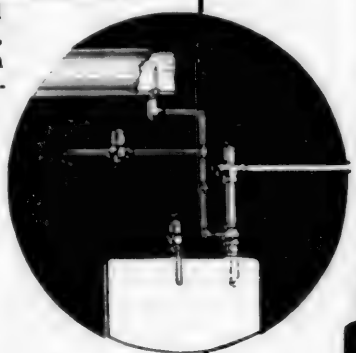
"By chance, we read an advertisement of your 'AIRTROL.' Knowing that any Bell & Gossett product can be purchased without the slightest doubt of its representation, we had the Airtrol installed on three new boilers in a section under construction. We have been free of heat complaints in the new section.

"After one year, we installed three Airtrols on the boilers serving buildings in older sections where complaints were heaviest. The results were beyond belief; as if by magic, our troubles vanished.

"This letter is to thank you, your great organization, and Mr. Curt Sundell, your most efficient representative here, for the complaint-free heating season where the Airtrols are installed.

"Thirty-five boilers heating the projects which we manage will be equipped with Airtrols this summer.

Very truly yours,
M. T. BROYHILL & SONS CORP.
(*signed*) Daniel C. Long, C. E.
Property Management Consultant"



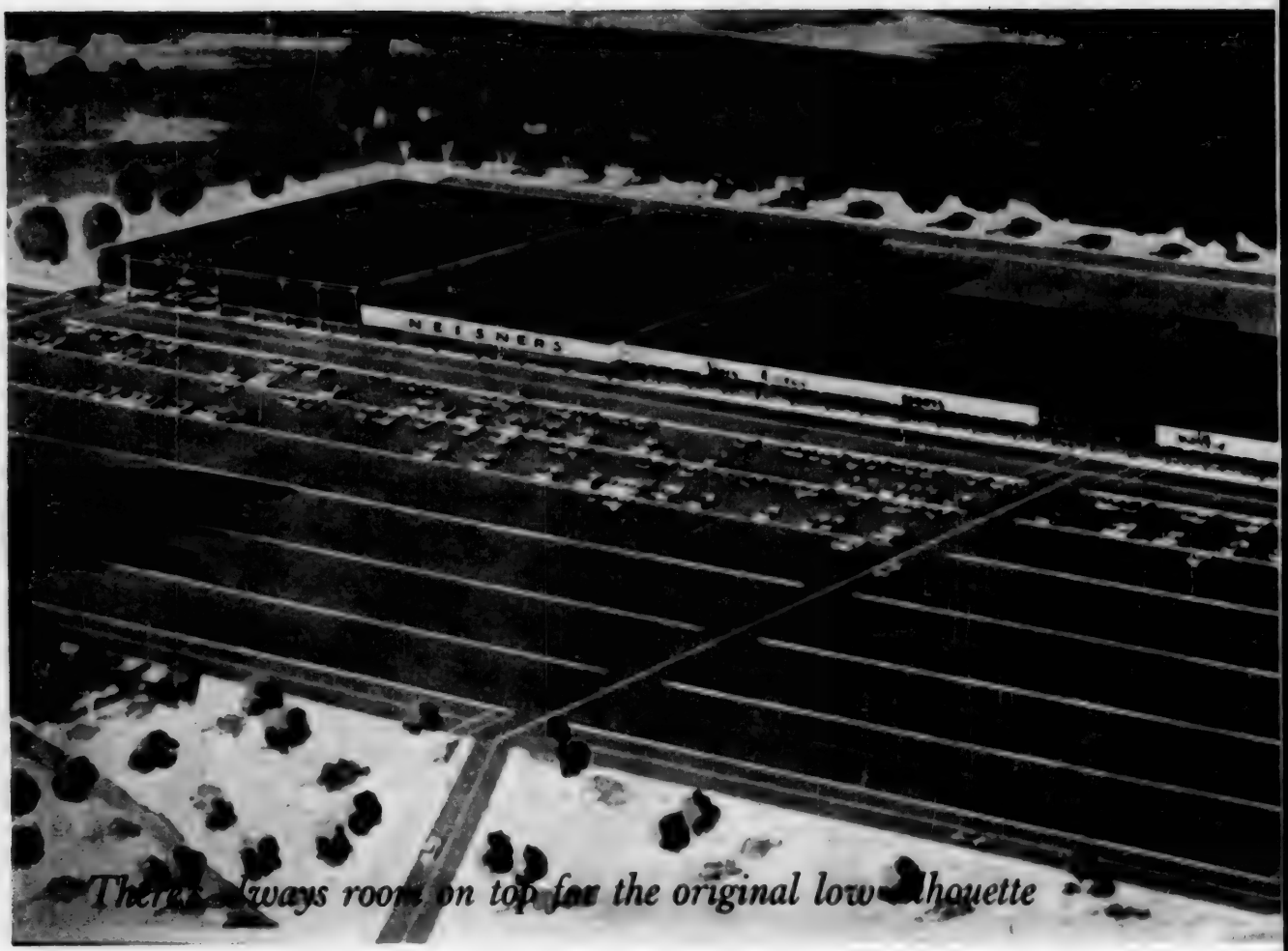
B&G Airtrol System installed on top outlet boiler.

B&G AIRTROL® SYSTEM

B&G Airtrol Systems are GUARANTEED to end air troubles in forced hot water systems

BELL & GOSSETT
COMPANY
Dept. GL-4, Morton Grove, Ill.

Canadian Licensee: S. A. Armstrong, Ltd., 1400 O'Connor Drive, Toronto 16, Ont.



There's always room on top for the original low silhouette

THE ATMOS-PAK

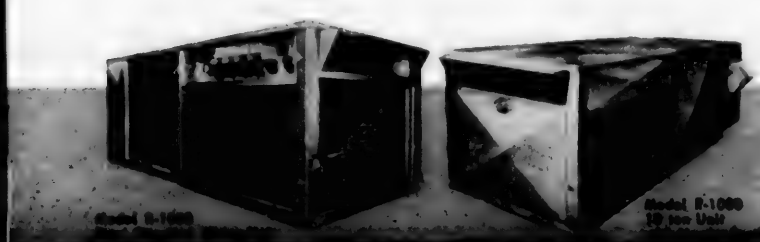
- *designed for low cost year-round air conditioning*
- *roof-mounted for more interior design freedom*
- *pre-fabricated for quick installation*

We list our exclusive features as proof that for any application involving one story structures — whether shopping centers, industrial plants, supermarkets, churches and synagogues, bowling alleys or post offices — our unit is the finest.

Year-round Unit
15 & 20 ton units
constructed in one section
30 & 35 ton units constructed
in two sections
5, 7½ & 10 ton
Single Circuited Unit
10, 15 & 20 ton Year-round Unit
Constructed in one section

Trenton Lane Shopping Center, Trenton, New Jersey
General Contractor — J. C. Breyfogle
Architects — Milosevich and Trautwein
Developers & Managing Agents — Garfield Associates

FEATURES	THE ATMOS-PAK	UNIT A	UNIT B	UNIT C	UNIT D	UNIT E
Mechanical Chimney	Yes	No	No	No	No	No
Individually Fused Motor Circuit	Yes	No	Yes	No	No	No
All Blowers of the Centrifugal Type	Yes	No	Yes	No	No	Yes
All Components Completely Protected from the Elements	Yes	No	No	No	No	Yes
Preformed Continuous Refrigerant Piping Circuits	Yes	No	No	No	No	No
Supply and Return Air Distribution Chamber with Controlled Air Pattern	Yes	No	No	No	No	No
Permanent Lubrication	Yes	No	No	No	No	No
No Field Assembly Required	Yes	Yes	Yes	No	No	No
Internal Service Switch	Yes	No	Yes	No	No	No
Automatic Condenser Air Discharge Hood	Yes	No	No	No	No	No
Distribution Chamber Adaptable to Duct Work	Yes	No	Yes	No	No	No
Universal Heater Section	Yes	No	No	No	No	No
Complete Line of Units 5 through 35 tons	Yes	No	No	No	No	No



designed, manufactured, installed and PIONEERED by
AIR CONDITIONING, INCORPORATED
88 North Highland Avenue
Ossining, New York

patented the atmos-pak

one p-k scalefree 230* used for—

1 - supplying all domestic hot water
2 - for baseboard radiant heating
3 - for reheat in air conditioning system

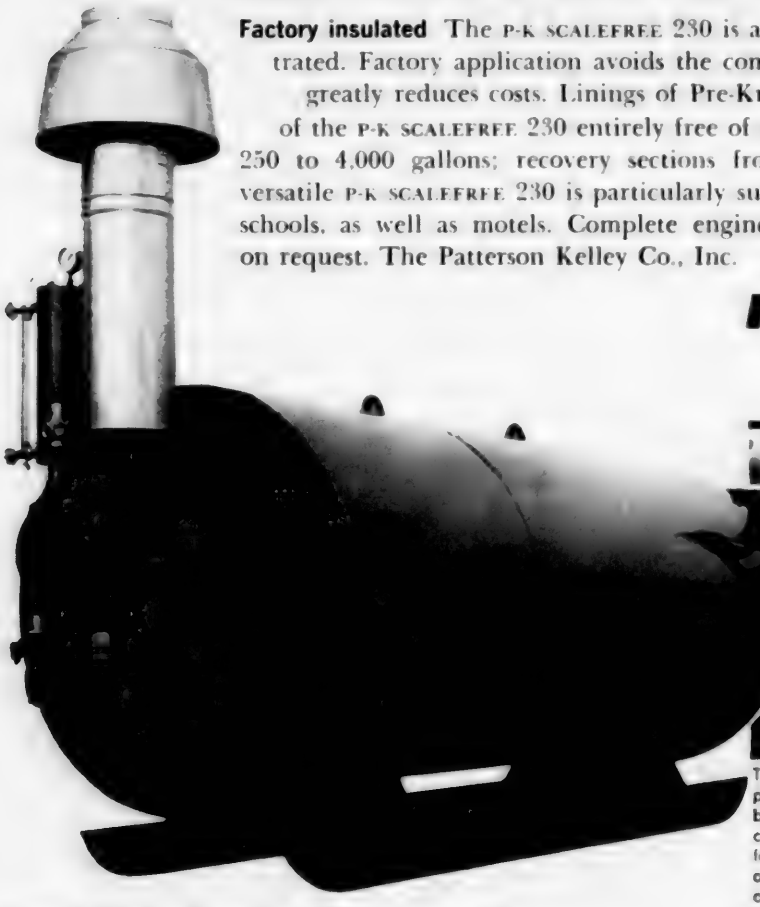
To supply all the hot water required for domestic service, baseboard heating, and reheat in air conditioning system, owners of the handsome Carousel Motel and Restaurant selected the new P-K SCALEFREE 230 . . . the industry's first indirect gas fired storage water heater. » » » High among reasons for choosing the P-K SCALEFREE 230 — It won't scale, and retains its rated efficiency, because heat transfer occurs below the temperature at which scaling minerals precipitate.

Quickly installed A complete and automatic package, the P-K SCALEFREE 230 can be skidded into place, hooked up and checked out quickly. There is no complicated piping or electrical work to run up installation costs. No stack is needed for extra draft. No foundation is necessary.

Factory insulated The P-K SCALEFREE 230 is available with factory insulation as illustrated. Factory application avoids the complications of on-the-site insulating and greatly reduces costs. Linings of Pre-Krete® or copper keep the storage section of the P-K SCALEFREE 230 entirely free of corrosion. Storage capacities range from 250 to 4,000 gallons; recovery sections from 390,000 to 2,215,000 B.T.U. The versatile P-K SCALEFREE 230 is particularly suited to office buildings, institutions and schools, as well as motels. Complete engineering and performance data available on request. The Patterson Kelley Co., Inc.

Patterson Kelley

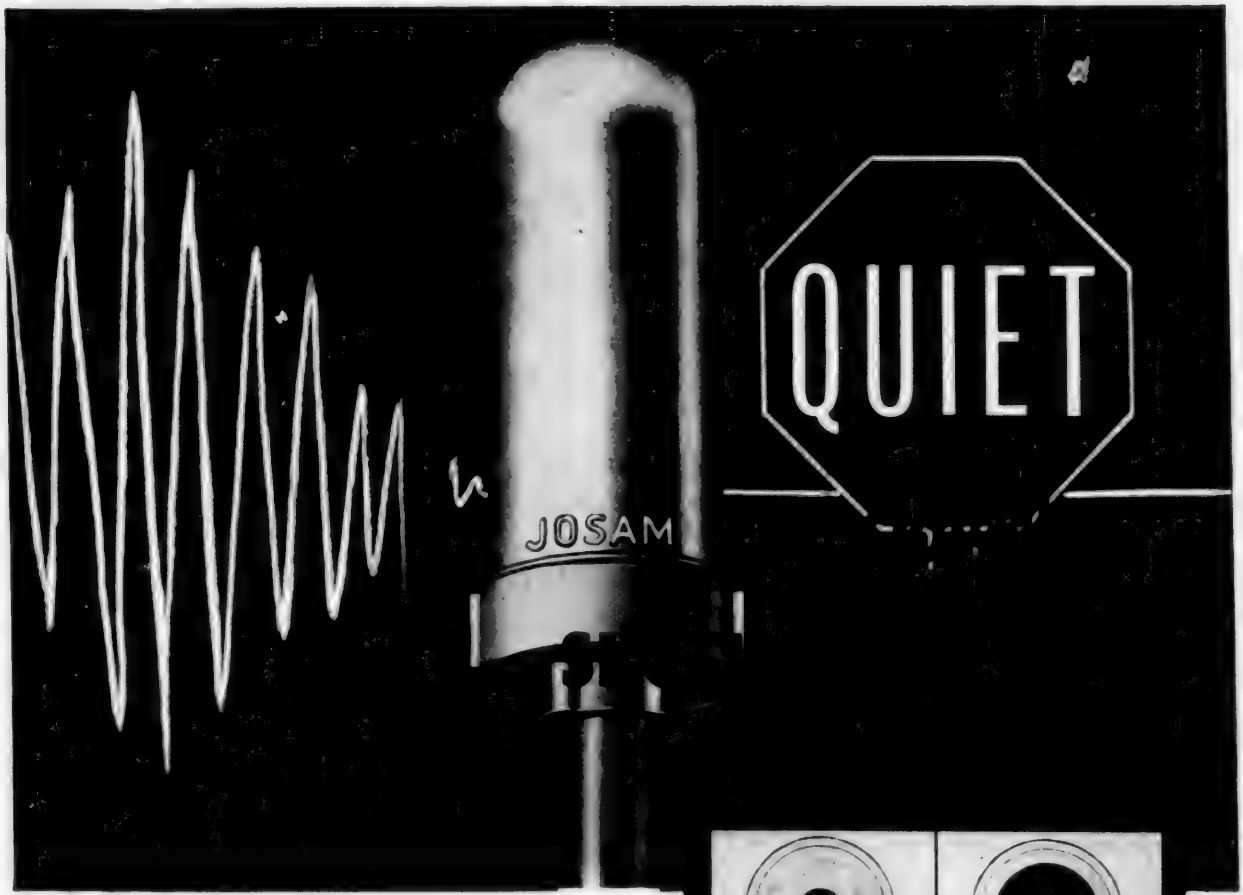
Water Heater Division
101 Morgan Avenue, East Stroudsburg, Pa



Heating-Air Conditioning Contractor, Kingston Electric Co., Kingston, Pa.

The Carousel Motel and Restaurant, with a capacity of 600 persons, recently opened at Wilkes-Barre, Pa., is owned by William Heck, William Heck, Jr., and Thomas Heck. They chose the P-K SCALEFREE 230 because it offered ideal performance and economy features for a service business such as theirs. The Pre-Krete lined unit has a storage capacity of 500 gallons, and a recovery rate of 325 gallons per hour from 40°F to 140°F.

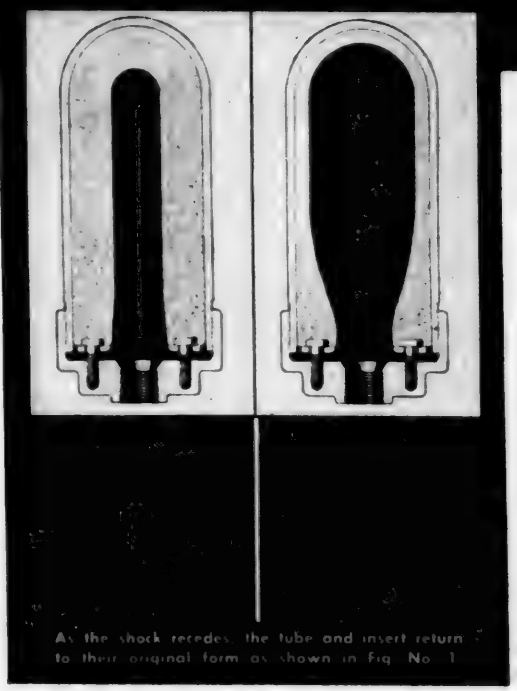
*Patent pending



QUIET

A supply line may have to be seen — but it should never be heard. A noisy pipe line signifies that "water hammer" is present and should be eliminated and if you could see inside the supply lines every time a faucet, valve or pump mechanism is suddenly closed, you would quickly see why the pipe, fittings and control devices fail under the repeated shock.

Every supply line should be protected with Josam Shock Absorbers because they eliminate "water hammer" completely . . . assure quiet . . . and cost so little compared to the damage they prevent. There are no springs to fail . . . no diaphragms to distend . . . no hydraulic fluids to replace. Simple construction assures dependable performance. For details describing proper methods of sizing and location of shock absorbers, write for Josam Manual SA-2.



As the shock recedes, the tube and insert return to their original form as shown in Fig. No. 1

Josam

JOSAM MANUFACTURING CO.

General Offices and Manufacturing Division • Michigan City, Ind.

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JOSAM PRODUCTS ARE SOLD THROUGH PLUMBING SUPPLY WHOLESALERS.

THE AIR IN THIS PLANT IS CLEANER THAN THE AIR A MILE ABOVE IT

The air in this plant **has** to be clean, because they make precision electronic parts here. It is the Collins Radio Company manufacturing plant in Cedar Rapids, Iowa . . . completely air-conditioned, and electronically air-cleaned with Westinghouse Precipitron*. Collins finds that clean, controlled air pays for itself in fewer rejects, more reliable products, and in reduced absenteeism. Write for our booklet describing the advanced air engineering concept Collins has adopted – based on Westinghouse air handling and air cleaning products. Dept. LV08, Sturtevant Division, Hyde Park 36, Massachusetts. **YOU CAN BE SURE . . . IF IT'S Westinghouse**

J-80708

IN TUBING— Nothing Beats Copper!

IN COPPER— Nothing Beats READING!

READING COPPER · BRASS TUBE

And RED BRASS PIPE

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MACKENZIE WALTON CORP., Pawtucket, R. I.

Completely Integrated Quality Control from Our Own Refinery to Our Own Distribution Depots

For SMALL, SEAMLESS PRECISION COPPER TUBE

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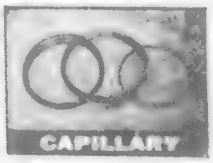
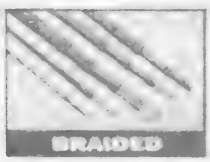
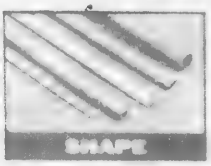
MACKENZIE WALTON

Product of MACKENZIE WALTON CORP.*







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- Band Instruments

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For COPPER WATER TUBE *Specify* READING "LEKTRONEAL"®

For COPPER REFRIGERATION TUBE *Specify* READING "LEKTROSEAL"®

For COMMERCIAL COPPER TUBE (in Varied Shapes) RED BRASS & COPPER PIPE, THREADLESS COPPER PIPE, COPPER DRAINAGE TUBE *Specify* READING

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Airline Grilles

All Extruded Aluminum Units for Floors, Sills and Walls

Streamlined Waterloo *Airline Grilles* fit perfectly into modern architectural and engineering concepts. These extruded aluminum grilles, available up to 12 feet in length in one piece construction, are excellent for every type of floor, sill and wall application.

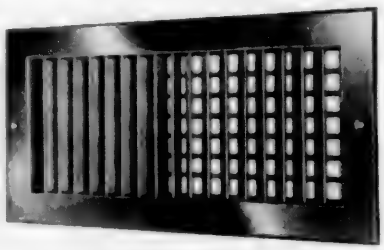
Designed to match a wide range of architectural finishes, Waterloo *Airline Grilles* feature a unique bar-support method that makes them practically tamper-proof. Since these units are designed with ¼" face bars on ½" centers, they are heel and pencil proof.

Write for comprehensive Selection Guide on these new multi-purpose Waterloo Grilles.

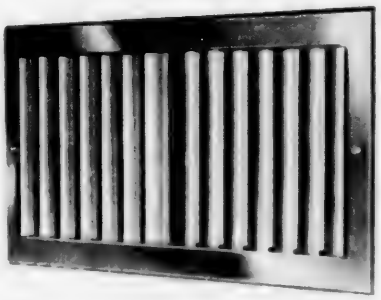
WATERLOO
Air Diffusion
EQUIPMENT

Waterloo Offers a Complete Line

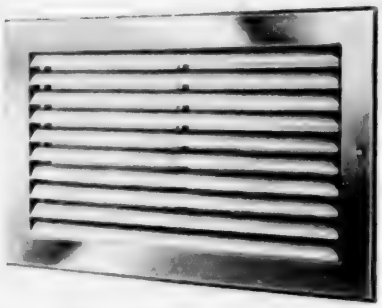
TYPICAL WATERLOO UNITS:



WATERLOO SUPPLY GRILLES ★ MODEL 2V



WATERLOO CURVED LOUVER GRILLES ★ MODEL 1CV2



WATERLOO RETURN AIR GRILLES AND REGISTERS ★ MODEL 3HD

WATERLOO REGISTER COMPANY, INC.
P.O. BOX 72, WATERLOO, IOWA

WR 110

Some basic steps to

SILENT VENTILATION

The Most Important Step you can take when it comes to deciding *which* power roof ventilator is right for you is to look at an Ilg LSQ. If *capacity* is a prime factor, step up and see Ilg's 11 sizes: from 87 c.f.m. all the way up to 21,000.

If it's *silent operation*, then check these features: direct-connected fan and motor eliminate belts and pulleys; patented Type "Q" wheel is dynamically balanced before being connected to permanent-split capacitor 1-phase or 3-phase motors; totally enclosed constant- and 2-speed motors assure smooth power flow.

For a *first* step toward better ventilation, write for Bulletin No. 2302.

ILG

ILG ELECTRIC VENTILATING CO.

2851 N. Pulaski Road,
Chicago 41, Ill.
Offices in
60 Principal Cities

Member of Air Moving
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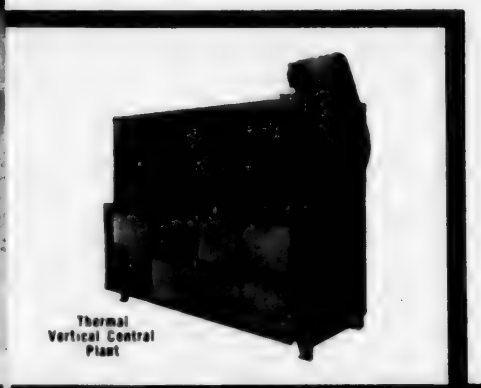
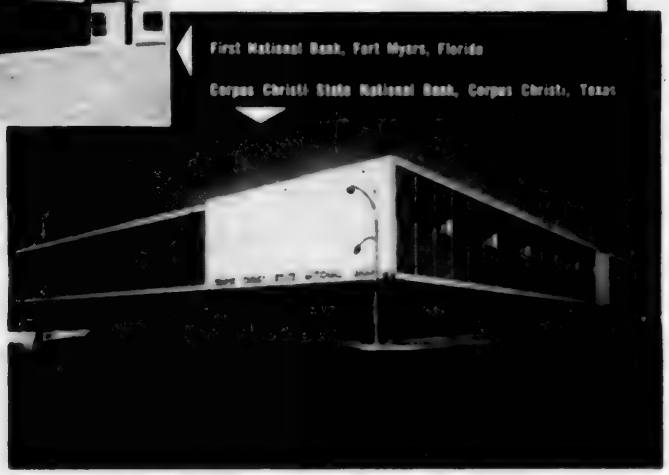


Thermal
Vertical Central
Plant



First National Bank, Fort Myers, Florida

Corpus Christi State National Bank, Corpus Christi, Texas

Satisfaction with THERMAL

that can't be discounted

Numerous Bank Buildings Depend on Thermal for Comfort

As the reputation for quality and dependability of Thermal air conditioning and ventilating equipment becomes known, more and more banks, as well as all other types of buildings, are using Thermal.

This is equipment with quality to give satisfaction and long life. Design features combine ready accessibility of internal components with rugged construction.

For further details on air conditioning and ventilating equipment you can specify with confidence, write for complete catalog and names of nationally known concerns using Thermal. The Thermal line includes central and multizone conditioners, sprayed coil units, heating and ventilating units, heating and cooling coils, and air-cooled condensers.

Here are some of the banks using Thermal equipment:

East Lake Branch of Birmingham Trust National Bank, Birmingham, Ala.
Commercial Bank, Andalusia, Ala.
Commercial National Bank, Daytona Beach, Fla.
First National Bank, Ft. Lauderdale, Fla.
Dade National Bank, Miami, Florida
Florida National Bank at Brent, Pensacola, Fla.
First Federal Savings & Loan Bldg., Hattiesburg, Miss.
East Central Branch, Bank of New Mexico, Albuquerque, New Mexico
Bank of Broken Arrow, Broken Arrow, Oklahoma
First National Bank, Muskogee, Oklahoma
First National Bank, Abilene, Texas
First Savings & Loan Bldg., Corpus Christi, Texas
Austin Savings & Loan Co., Austin, Texas
North Austin State Bank, Austin, Texas
Security State Bank, Beaumont, Texas
American National Bank, Beaumont, Texas
Farm-Home Savings & Loan Bldg., Ft. Worth, Texas
Raymondville State Bank, Raymondville, Texas
First National Bank, Rockport, Texas
Bellaire State Bank, Bellaire, Texas
Lockhart Savings & Loan Bldg., Lockhart, Texas
First National Bank, Giddings, Texas
Grove State Bank, Dallas, Texas
San Jacinto State Bank, Houston, Texas
First National Bank, Refugio, Texas
Tyler Bank & Trust Co., Tyler, Texas

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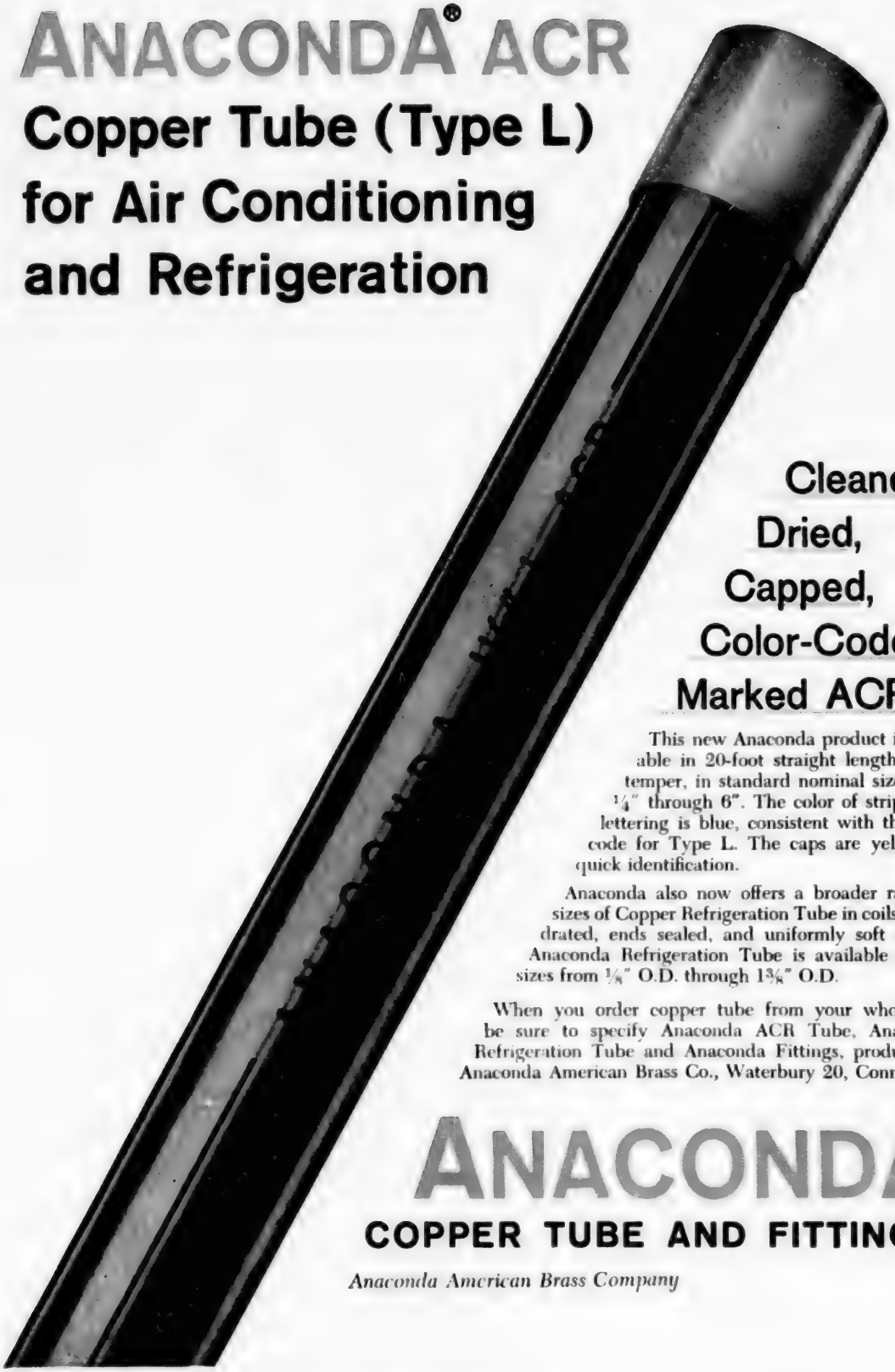
AGENTS IN PRINCIPAL CITIES

Now available

ANACONDA® ACR
Copper Tube (Type L) for Air Conditioning and Refrigeration



Cleaned, Dried, Capped, Color-Coded, Marked ACR.

This new Anaconda product is available in 20-foot straight lengths, hard temper, in standard nominal sizes from ¼" through 6". The color of stripes and lettering is blue, consistent with the color code for Type L. The caps are yellow for quick identification.

Anaconda also now offers a broader range of sizes of Copper Refrigeration Tube in coils—dehydrated, ends sealed, and uniformly soft temper. Anaconda Refrigeration Tube is available now in sizes from ⅛" O.D. through 1⅜" O.D.

When you order copper tube from your wholesaler be sure to specify Anaconda ACR Tube, Anaconda Refrigeration Tube and Anaconda Fittings, products of Anaconda American Brass Co., Waterbury 20, Conn.

ANACONDA®
COPPER TUBE AND FITTINGS

Anaconda American Brass Company

Gives You MORE, Costs You LESS Check all the FEATURES!*

RP

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Multi-Velocity INDUSTRIAL AIR FILTER

FOR HEATING OR AIR CONDITIONING

✶ **ALUMINUM** construction...rust-proof...corrosion-resistant. Eliminates need for expensive, heavy structural design in filter bank construction.

✶ **EASY TO HANDLE** Light-weight permits carrying, washing and installing of many more filters per hour.

✶ **EASY TO CLEAN** Lint and dirt are easily flushed off with water because of water soluble Super Filter Coat (the adhesive with the built-in detergent).

✶ **DEPTH LOADING** Designed to minimize surface loading, with depth loading accomplished through successive layers of slit and expanded aluminum, and varying baffle sizes.

✶ **REMOVES ODORS** Revolutionary R P Super Filter Coat adhesive adds odor removal to the normal dirt-trapping properties of R P Industrial Air Filters —with no increase in resistance—at *no* extra cost!

✶ **GERMICIDAL** Super Filter Coat adhesive contains Hexachlorophene, the well-known bacteria destroying agent.

✶ **LOWER RESISTANCE** Unique baffle design permits maximum air passage...more uniform dust collection within the filter depth.

✶ **HIGHER EFFICIENCY** Scientifically staggered pattern of flat baffles sets up a controlled turbulence that centrifuges dust and odor particles onto the adhesive for maximum efficiency.

for information, write RP / *Products of Research*

RESEARCH PRODUCTS *Corporation* Dept. 47-L, Madison 1, Wisconsin

New Airfoil Bladed Fans Whisper

Here's a completely new line of Airfoil Bladed Fans from American-Standard Industrial Division with an exclusive radial rim wheel design that substantially lowers air velocity through the blast area of the wheel. This new design, plus airfoil blading, reduces turbulence and results in unusually quiet fan operation. Exceeding 90% in mechanical efficiency, American-Standard* Airfoil Fans are ideal for both general ventilation and industrial process applications. And every one carries the AMCA certified rating seal. Get all the facts. Send for Bulletin A-1103 today. American-Standard Industrial Division, Detroit 32, Michigan. In Canada: American-Standard Products (Canada) Limited, Toronto, Ontario. *AMCA Certified Ratings*

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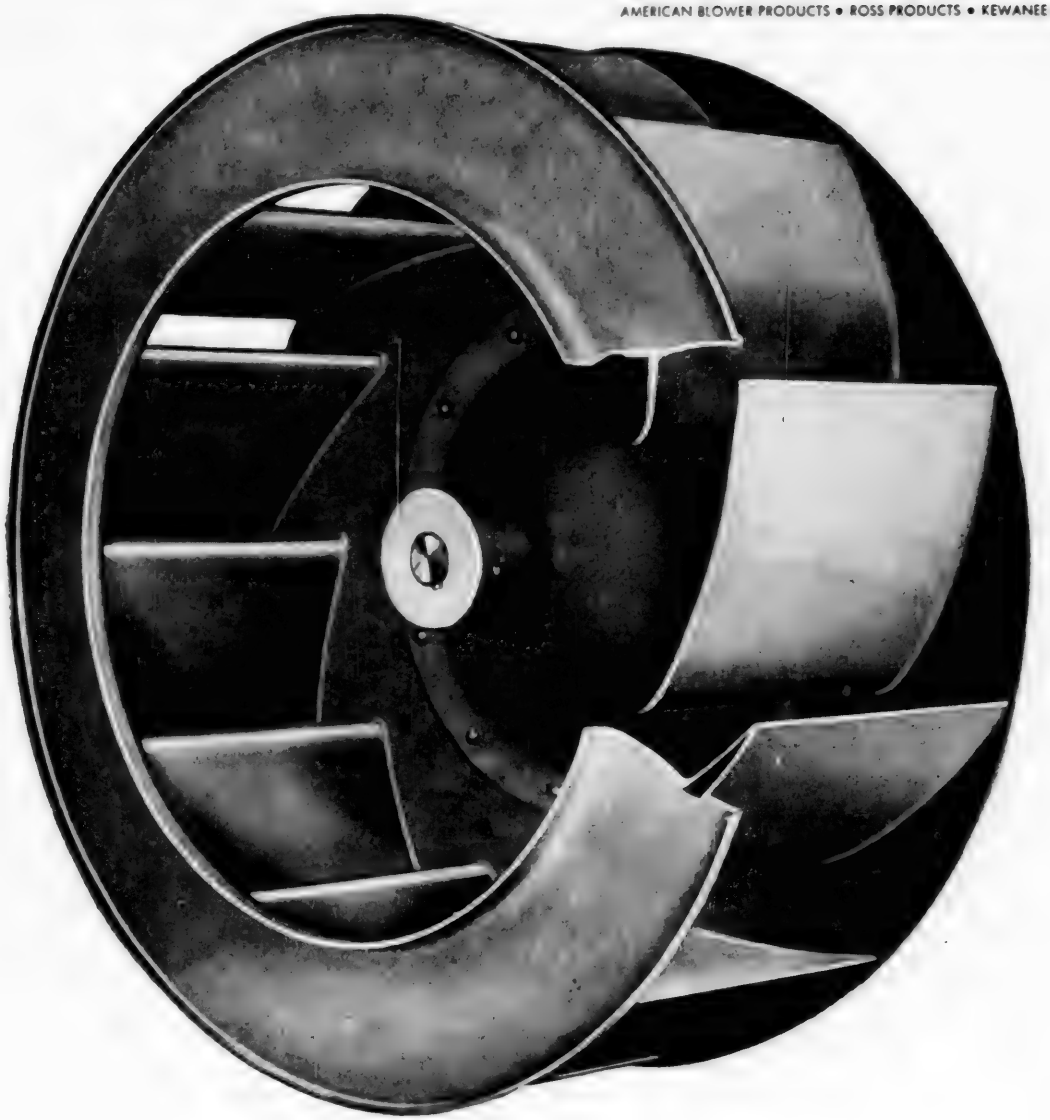
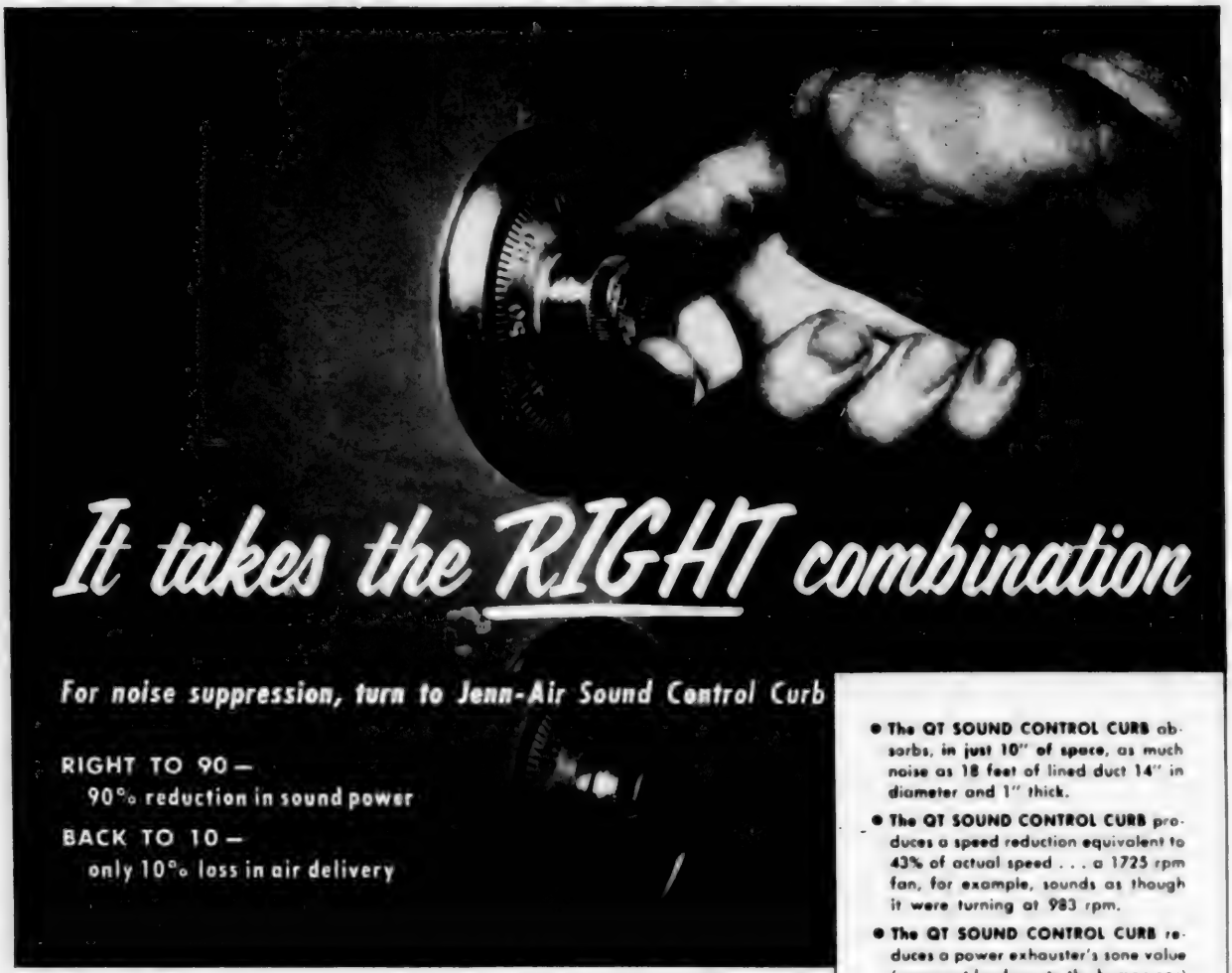




It takes the RIGHT combination

For noise suppression, turn to Jenn-Air Sound Control Curb

RIGHT TO 90—
90% reduction in sound power

BACK TO 10—
only 10% loss in air delivery

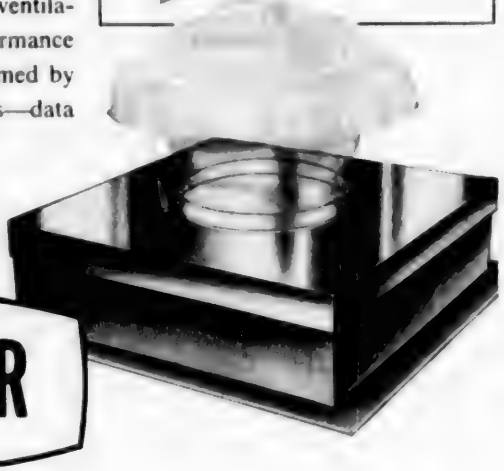
- **The QT SOUND CONTROL CURB** absorbs, **in just 10" of space,** as much noise as 18 feet of lined duct 14" in diameter and 1" thick.
- **The QT SOUND CONTROL CURB** produces a speed reduction equivalent to 43% of actual speed . . . a 1725 rpm fan, for example, sounds as though it were turning at 983 rpm.
- **The QT SOUND CONTROL CURB** reduces a power exhauster's sone value (apparent loudness to the human ear) by approximately two-thirds.
- **The QT SOUND CONTROL CURB** offers effective noise control in an easily-installed, self-flashing, prefabricated curb.

Leader in functional IMAGINEERING . . .

The "right combination" in power exhauster curbs is (1) effective noise suppression *plus* (2) high air delivery. Only *one* unit provides both! The Jenn-Air QT Sound Control Curb reduces exhauster sound power 90% with only a 10% loss in air moving capacity! This achievement is the result of unique Jenn-Air patent-protected design features.

Both "right combination" factors deserve equal consideration from the engineer. Good attenuation ratings are worthless if achieved at the expense of air delivery. By the same token, claims of unrestricted air flow probably mean that little or no attenuating ability can be expected.

Get *all the facts* before you specify . . . prove to yourself that Jenn-Air's QT Sound Control Curb represents a major breakthrough in the field of noise control for power roof ventilation. The QT curb's performance ratings (see box) are confirmed by independent laboratory tests—data available on request.



JENN-AIR

JENN-AIR PRODUCTS COMPANY, INC. 1102 Stadium Drive · INDIANAPOLIS 7, INDIANA

Member Air Moving & Conditioning Association

HOW TO DESIGN A TRADEMARK

Why, it's easy as A-B-C. Just start with a simple shape, one that's readily identified and easily remembered. (The Jenkins Diamond is a good example.) Then just fill in the blank spaces. That's all there is to it, and almost anyone can do it!

HOW TO MAKE IT MEANINGFUL

Ah, that isn't so easy nor so simple.

A trademark is like a man's signature: it can mean much or it can mean little.

Time and *performance* make the difference.

Take the Jenkins Bros. trademark. There's nothing tricky about the design, certainly nothing fancy about the words.

Yet buyers and specifiers of valves everywhere know and respect this simple device, this mark.

Why? Because in all the years since 1864 there has been no compromise in the *quality* of Jenkins Valves. We know it; you know it.

And that is the only way we know to make a trademark *meaningful*. That will always be the Jenkins way of making valves.

JENKINS®

Jenkins Bros

JENKINS BROS., 100 PARK AVENUE, NEW YORK 17

Quiet...

WAGNER Polyphase Resilient Mounted Motors in ratings through 10 horsepower

Quiet, vibration-free performance is essential when motors are installed in areas where noise must be held to a minimum . . . in hospitals, churches, schools, office buildings, restaurants and similar locations where quiet is needed or wanted.

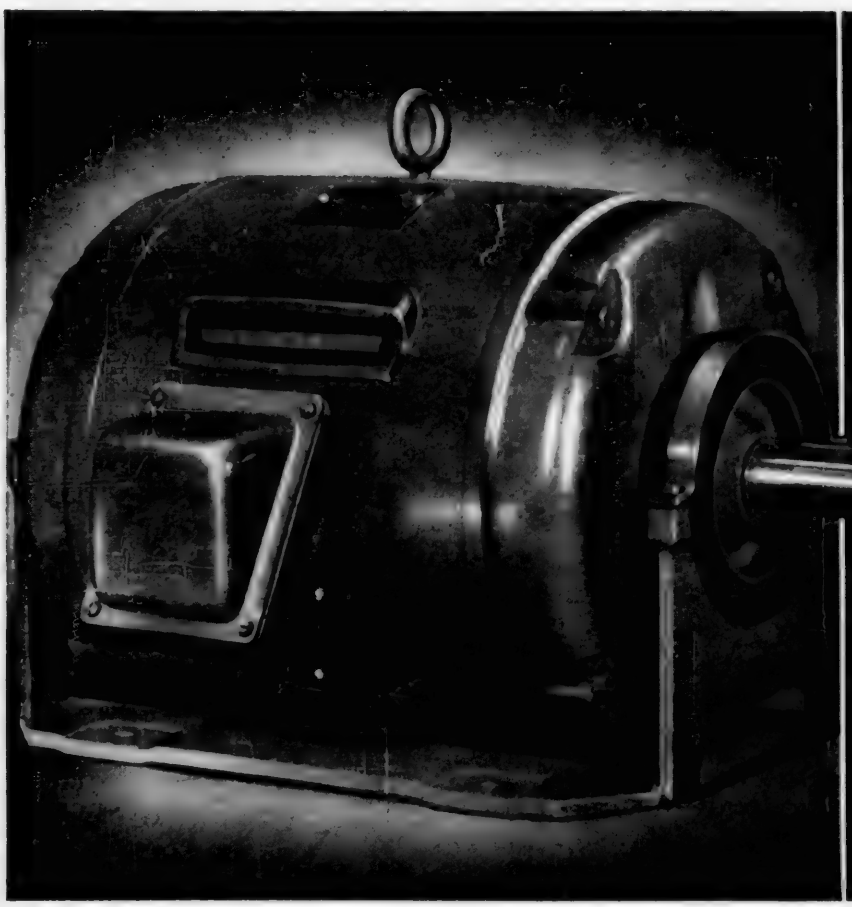
Such installations have created a need for larger polyphase motors that whisper while they work. Wagner has met this need by expanding its line of polyphase resilient mounted motors to include standard ratings through 10 hp.

You certainly have applications that call for a smooth running motor, cushioned by resilient mountings. To make sure they're quiet, specify Wagner Polyphase Resilient Mounted Motors. Only Wagner can provide an entire range of ratings through 10 hp.

Constant research and development have kept Wagner up front in electric motor design for more than 65 years . . . made the name Wagner one you can depend on in choosing electric motor drives.

Your nearby Wagner Sales Engineer can help you select the right motor to meet your requirements. There are Wagner branch offices in 32 principal cities.

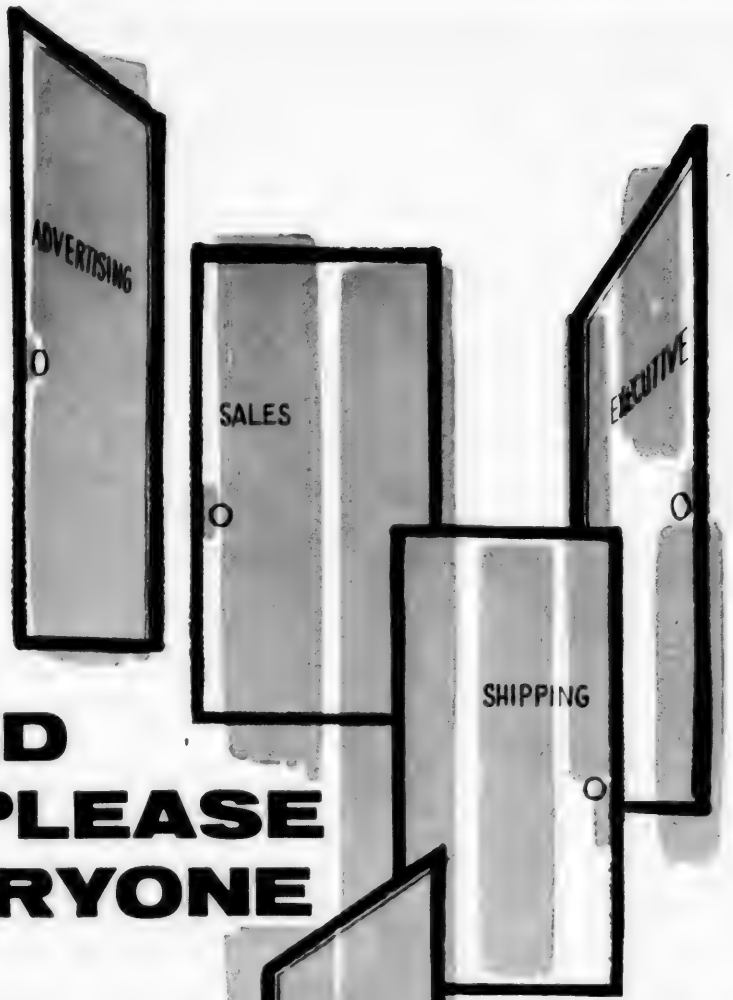
Wagner Electric Corporation
6463 PLYMOUTH AVENUE, ST. LOUIS 33, MISSOURI



SLEEVE OR BALL BEARING
These motors are furnished with quiet running steel-backed babbitt-lined sleeve bearings of high load carrying capacity. Ball bearings can be supplied when desired.

CEILING, SIDEWALL OR HORIZONTAL MOUNTING
You can mount these motors on walls or ceilings by rotating the cradle base 90° or 180°. Motor stays dripproof.

NEOPRENE CUSHIONING RING
Annular mountings, of oil-resistant neoprene bonded to steel rings, cushion the motor in its cradle base to absorb the small amount of vibration that remains in the most carefully balanced motor.



IT'S HARD TO PLEASE EVERYONE

- - - BUT *Buffalo Zone Conditioning Comes Awfully Close!*

From one central cabinet here's individual year 'round comfort conditioning to suit **many** different areas of a building. Each zone is controlled automatically. Consider these exclusive ***Buffalo*** features:

RUGGED TUBULAR FRAME — easily assembled and installed. Convenient to service thru handy access doors, removable panels and outside bearings.

CHOICE OF COMBINATIONS — floor or suspended mounting arrangements — any combination of heating, cooling or humidity control.

LOW HEAD ROOM due to 45° pitched coils.

PERMANENCY—DEPENDABILITY — heavy-gauge, corrosion-resistant paneling, coils, pans and dampers; high-quality backward curved limit load fans; heavy-duty ball or sleeve bearings.

Exclusive individually sized damper zones to accurately proportion quantity of air flow.

Buffalo Zone Control Cabinet, Type PCB

Write today for Bulletin AC-220.

BUFFALO FORGE COMPANY

Buffalo, New York

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

"Buffalo"

Buffalo air handling equipment to move, heat, cool, dehumidify and clean air and other gases

Buffalo Machine Tools to drill, punch, shear, bend, slit, notch and cope for production or plant maintenance

Buffalo Centrifugal Pumps to handle most liquids and slurries under a variety of conditions.

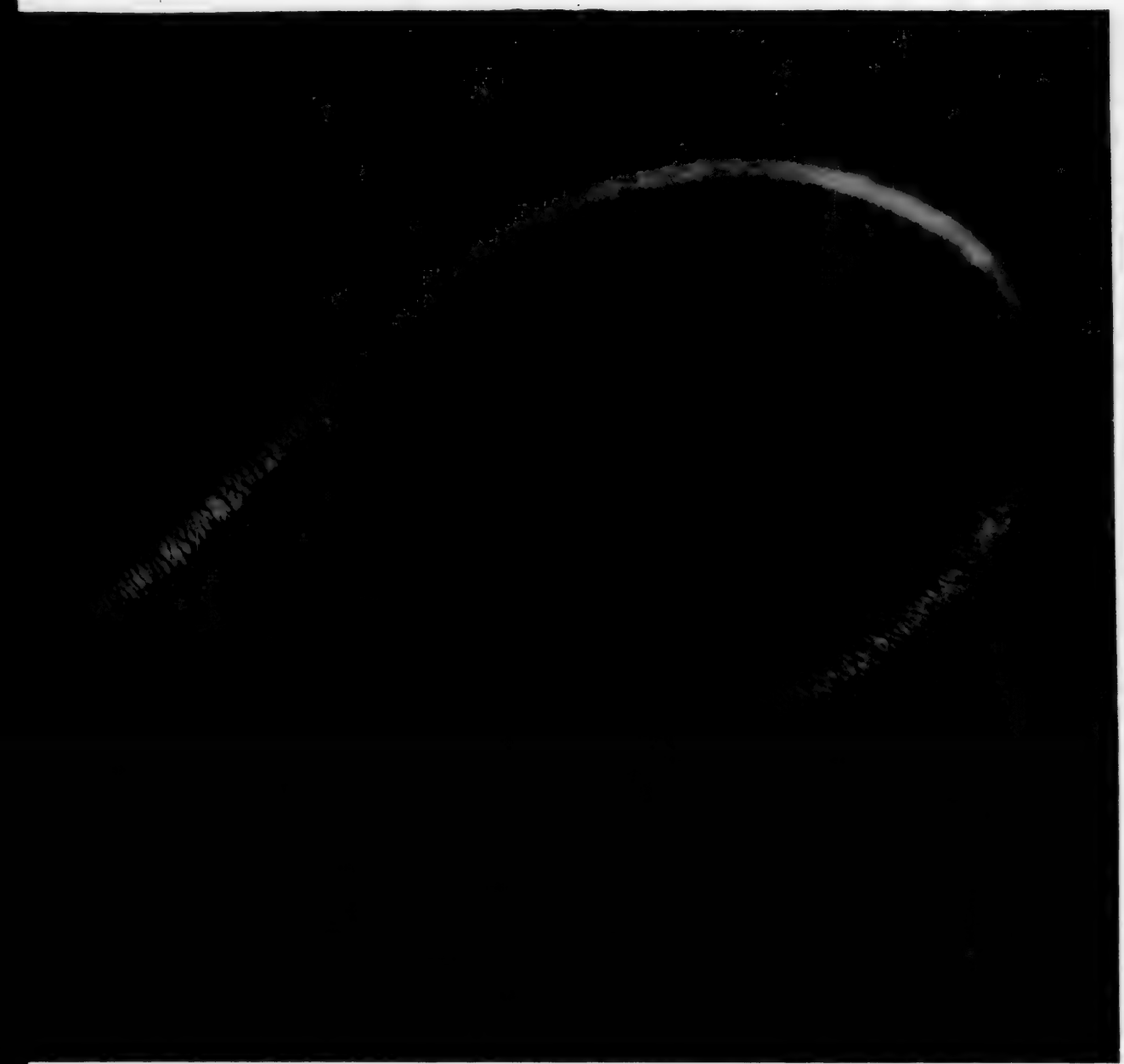
Squier machinery to process sugar cane, coffee and rice. Special processing machinery for chemicals.

Stop pipe condensation with the built-in vapor barrier of J-M Aerotube

...THE FLEXIBLE, FOAMED PLASTIC PIPE INSULATION THAT CUTS INSTALLATION COSTS IN HALF.

For heating, plumbing and air-conditioning service—wherever sweating or condensation is a problem—Johns-Manville Aerotube® is the economical solution.

Aerotube is a tubular pipe insulation for use at temperatures from 32F to 220F (double layer of Aerotube permits range of 0F to 220F). Its closed cell structure stops the passage of moisture. This built-in vapor barrier, plus the insulating effectiveness of Aerotube, will prevent condensation under normal design conditions on indoor lines. What's more, you



can depend upon Aerotube to maintain its effectiveness indefinitely.

Aerotube is the easiest-to-install pipe insulation available today. On a straight run of pipe or the most complex bend, Aerotube's six-foot lengths go on quickly. For connected pipe, just slit Aerotube longitudinally, snap it on, and seal it up! You'll discover that labor costs are substantially reduced when Aerotube is chosen to solve condensation problems.

Available in a wide range of thicknesses, there's an Aerotube insulation that meets your particular needs. For full information, send for brochure IN-213A. Write Johns-Manville, Box 14, New York 16, N. Y. In Canada: Port Credit, Ontario.

Even the most complex bend is easy to insulate with flexible J-M Aerotube.

JOHNS-MANVILLE

AN INSULATION FOR EVERY COMMERCIAL AND INDUSTRIAL USE

You pay no more for unequalled SLOAN quality...

Flush urinals *Automatically*

WITH THE Sloan Flushing System

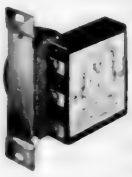
In public and semi-public toilet rooms, the Sloan Automatic Flushing System provides important benefits for both user and owner. It is the most ideal method of urinal operation ever devised.

Pioneered through Sloan research, the system:

- Eliminates the need of user operation
- Encourages better housekeeping of the toilet room
- Assures more hygienic conditions

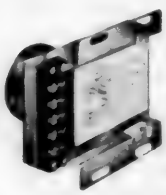
The Sloan Automatic Flushing System provides accurate electric clock timing; is dependable in operation and trouble-free . . . while saving tremendous quantities of water. The Sloan Urinal Flush Valve is actuated by a Motor Operator (illustrated above); the flushing cycle is controlled by any one of several Timers (explained in captions below).

Thousands of installations in satisfactory daily service prove the Sloan Automatic Flushing System. Here is another product packed with that bonus of quality you expect from Sloan. And, since you can have Sloan quality at no extra cost, why not make sure you get it.



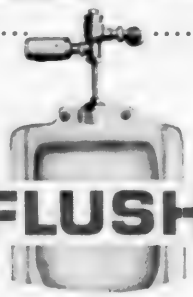
SINGLE CIRCUIT TIMER for flushing one Flush Valve (or two simultaneously).

THREE CIRCUIT TIMER for sequential flushing of three Flush Valves. Either one connected to light switch so that flushing occurs only when light is on and toilet room ready for use.



DOOR-OPERATED TIMER employs door switch (not furnished) which starts Timer as user enters toilet room. Flushing occurs within succeeding five minutes while successive door openings have no effect.

DAY-NIGHT TIMER for large number of Flush Valves. Controls urinal Flush Valves for each toilet room in sequence at five minute or one hour intervals according to traffic hours of the building.



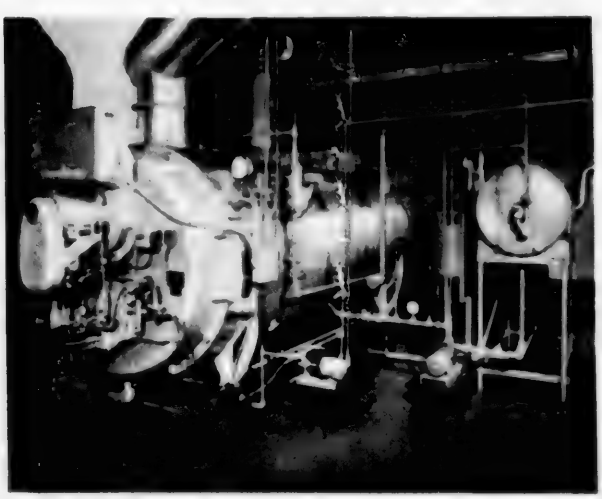
SLOAN FLUSH VALVES

SLOAN VALVE COMPANY • 4300 WEST LAKE STREET • CHICAGO 24, ILLINOIS

can you afford to recommend a boiler designed 20 years ago?

GETTING MORE HEAT FOR THE FUEL DOLLAR

The W. T. Rawleigh Company, manufacturer of toiletries, medicines and food products for the home and farm, replaced two old firebox boilers in their Memphis, Tennessee, branch with one fully automatic, combination-fired CB boiler. Mr. James Trindle, office manager, reports: "Our records show . . . 36.4% less fuel consumed during winter months that averaged about 12% colder than the previous year. We're getting greater fuel economy than we expected."



Since World War II, *less* than 20 years ago, fuel prices have soared. And these higher costs put a premium on "little" boiler inefficiencies that might have been ignored when most boilers were designed.

In the face of rising fuel costs, one manufacturer, Cleaver-Brooks, has led the way in up-to-date, "designed in" economy. Modern Cleaver-Brooks packaged boilers provide a combination of fuel-saving design standards that cannot be found in any other boiler — at any price.

It is this combination of features — four-pass design, forced-draft combustion, updraft construction and all the advantages of five square feet of heat-transfer surface per boiler horsepower — that puts fuel costs down where they belong.

All this is provided by Cleaver-Brooks in the most compact, automatic packaged unit on the market. Sizes through 600 hp . . . oil, gas and combination oil-gas firing . . . larger sizes in Cleaver-Brooks Springfield water-tube boilers. All models completely pre-engineered and tested as a package . . . expertly started by a trained field engineer.

See your local Cleaver-Brooks agent or write for a set of boiler-room templates designed for consulting engineers.

Cleaver Brooks®

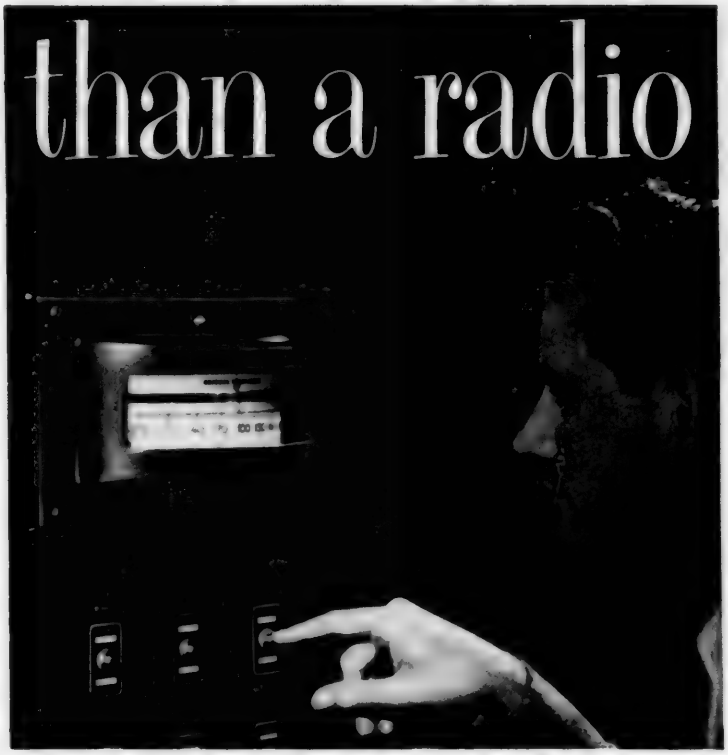
ORIGINATOR AND LARGEST PRODUCER OF PACKAGED BOILERS

CLEAVER-BROOKS COMPANY

Dept. P, 315 E. Keefe Ave., Milwaukee 12, Wisconsin

ELECTRONIC control .

. . simpler than a radio



More reliable than an elevator

Everywhere you turn, reliable electric and electronic components and systems work for you. You hardly think about them — your radio, an elevator, your dictating machine, the generator cutoff in your automobile.

Barber-Colman *Electrionic* control for heating, ventilating, and air conditioning provides even more dependable service than the items listed above. It combines electric and electronic components to give you fast, accurate sensing and adjustment of temperatures and air flow. You don't have to convert electrical energy into mechanical energy in an *Electrionic* control system — it makes direct use of the electrical power that's available in every building.

Simpler than a radio, it's easy to service. More reliable than an elevator, it seldom needs attention. It is instantaneously responsive and extremely accurate. For large or small installations, *Electrionic* control often costs less in the first place, and always costs less in the long run.

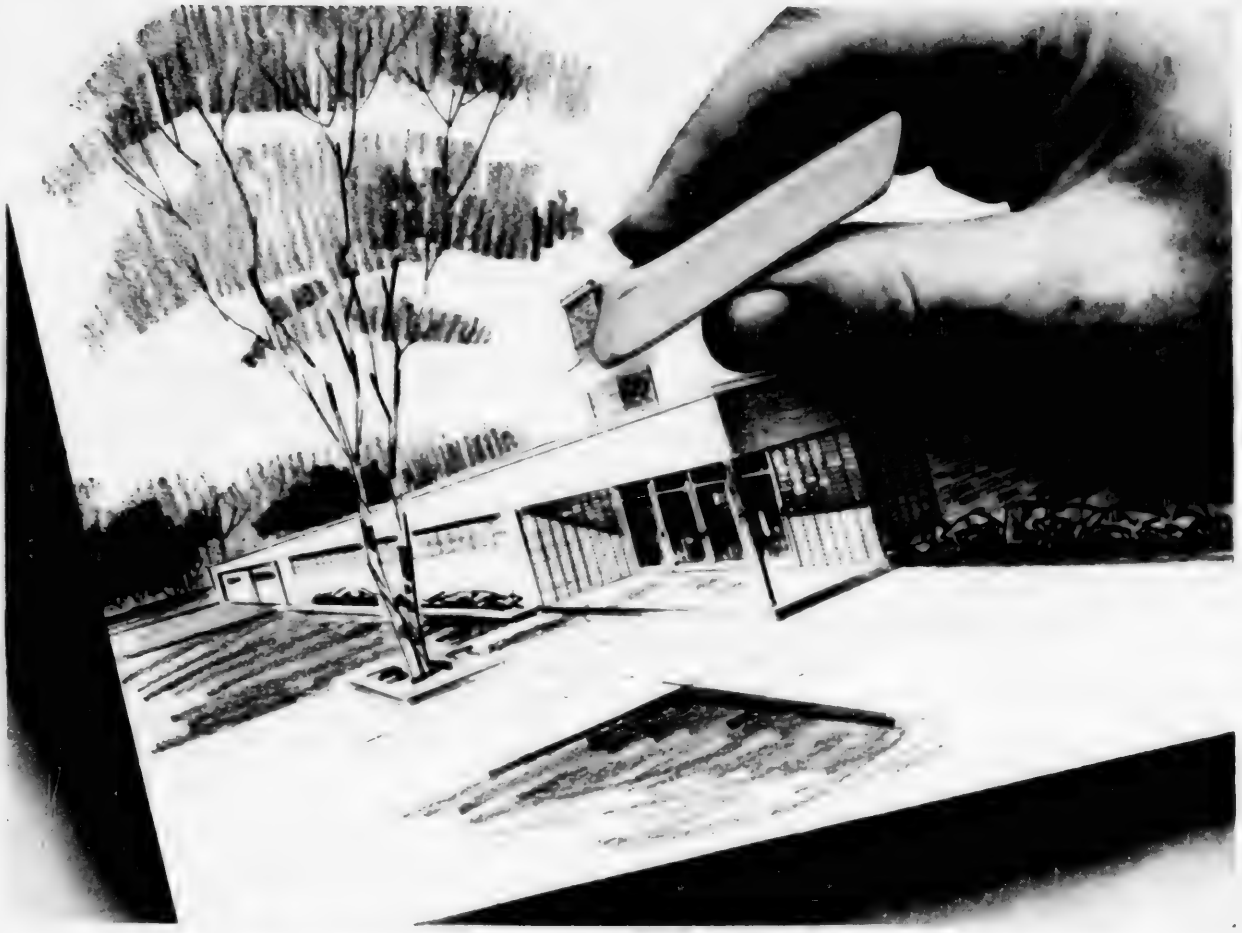
You don't have to be an electric or electronic engineer to understand *Electrionic* control. You will feel right at home with it after you've read Barber-Colman's new *Electrionic* Handbook which graphically explains the principles in a very readable way. You're welcome to a copy. Just call your local Barber-Colman automatic controls office or write:

. . . to operate transistorized motor operators for accurate control of air and liquid flow.

BARBER COLMAN

BARBER-COLMAN COMPANY

Dept. L, 1302 Rock Street, Rockford, Illinois



FORGET THE CHIMNEY WHEN YOU SPECIFY A WEIL-McLAIN TYPE "J" GAS BOILER

The Weil-McLain Type "J" Cast Iron Gas Boiler does not need a high chimney which breaks up the smooth sweep and flow of modern architecture...nor is a draft fan necessary. It conforms to A.G.A. venting requirements...products of combustion can be expelled with only a 5 foot vent riser beyond the draft hood openings. Where building conditions require a longer vent, design and sizing data are available from Weil-McLain.

Other highlights of "J" Boiler design

1. A.G.A. approved efficiency of 80%.
2. Compact design saves boiler-room space—up to 50%.
3. A.G.A. approved for all gases.
4. Electronic controls and pre-wired control panels engineered as part of unit.
5. No refractories, motors, fans, tubes or water treatment.
6. Can be assembled at any stage of building construction.
7. 33 sizes in 500 gross sq. ft. increments permit close sizing.

Send for Bulletin C-297. For oil boiler information see Engineers' Product File or Sweet's Architectural File.

Type "J" Gas Boiler
Net I=B=R Ratings, steam and water, 360,100—3,354,000 BTU/hr.

WEIL-McLAIN
CAST IRON BOILERS

WEIL-McLAIN COMPANY • Dept. BB-120 • MICHIGAN CITY, INDIANA

The skating is fine in Atlantic City

. . . on rinks built with steel pipe

"Ice skating on our private rink" is a sign now frequently seen next to "Tourist Accommodations" in Atlantic City, N. J. The four establishments shown here have found this added attraction a great help in extending the tourist season throughout all twelve months of the year.

Attractive, too, to the builder and contractor alike, is the promise of long rink life given to each of these rinks by Bethlehem steel pipe. And the low cost of steel pipe is another big feature—it's considerably less expensive than any other ferrous piping material. What's more, steel pipe is available in double-random lengths—and can be fabricated *cold!*

Practical advantages like these make steel pipe the first choice for ice rink installations. Your pipe distributor will be glad to talk it over with you. Or call the nearest Bethlehem sales office.

Steel

for Strength . . . Economy . . . Versatility

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

Export Sales: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL

Colony Motel

Ice rink: 35 x 70 ft
Architects: A. L. & Stanford G. Brooks
Engineer: Jack P. Hartmann
Contractors: Benjamin E. Labov & Sons
Pipe Jobber: Seashore Supply Co.

Empress Motel

Ice rink: 40 x 100 ft
Architect: Rodney C. Williams
Engineers: S. B. & B. H. Strouse
Contractors: Benjamin E. Labov & Sons
Pipe Jobber: Seashore Supply Co.

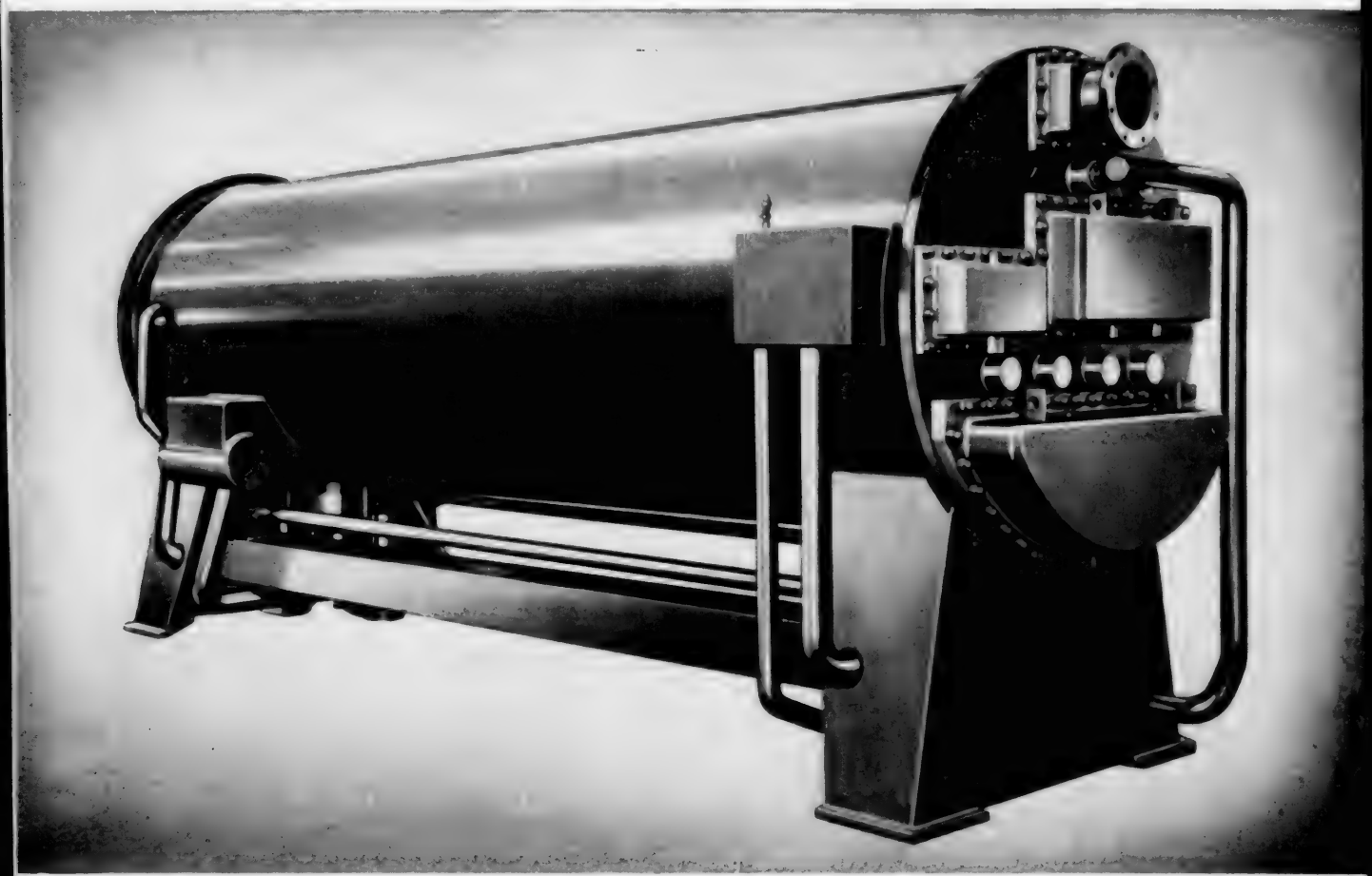
Chelsea Hotel

Ice rink: 35 x 70 ft
Piping Engineers and Contractors: Benjamin E. Labov & Sons
Pipe Jobber: Seashore Supply Co.

President Hotel and Motel

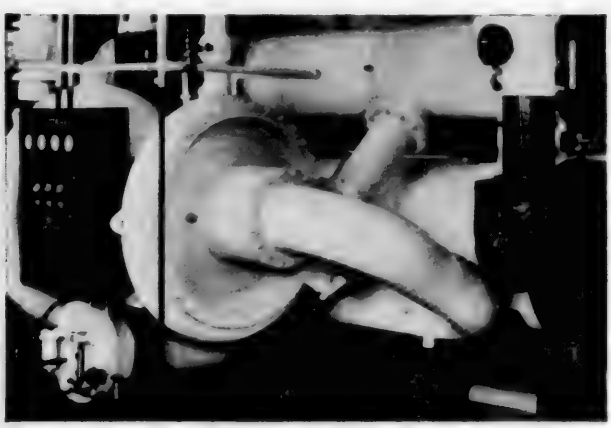
Ice rink: 45 x 90 ft
Architect: Rodney C. Williams
Engineers: S. B. & B. H. Strouse
Contractor: Wm. J. Crane Company
Pipe Jobber: Seashore Supply Co.

Now! Low-cost industrial Trane Hermetic



For industrial process cooling or comfort air conditioning—wherever there is a supply of low-cost steam—the new TRANE Absorption Cold Generator is available in twelve sizes, 100 to 530 tons . . . making it easy to select a unit to match the exact requirements; means fuel savings and efficient part load operation.

There's Trane matched equipment for every air conditioning need...



Hermetic CenTraVac water chiller with electric drive modulates to 10% of capacity, or lower, with power savings in almost direct proportion to load. Compact, with low silhouette design. Open type compressor models for any type of drive and steam turbine CenTraVacs are available.

New Reciprocating Cold Generator now hermetic—with TRANE built chiller and condenser. Provides efficient water chilling for a wide variety of applications. Factory-wired control panels mounted on unit to eliminate on-the-job wiring. Features new TRANE Hermetic Reciprocating Compressor.

water chilling...with a Absorption Cold Generator

Advanced hermetic design, single-shell construction provide simplified installation, minimum maintenance, economical operation for process or comfort cooling

Here's a compact packaged hermetic absorption water chiller—the TRANE Absorption Cold Generator. It's designed to provide a dependable, economical source of chilled water for process or comfort cooling in industrial plants, hotels, apartments and office buildings—wherever there is a supply of steam or hot water.

The advanced *hermetic* design assures reliable operation under all operating conditions . . . prevents air from entering the system which causes crystallization, deterioration and maintenance problems. The machine operates under conditions which avoid crystallization. (If power failure or other temporarily abnormal conditions occur, the machine will tend to free itself of any resulting crystallization.)

Fully automatic operation means no full time attendant is needed. The unit responds immediately and automatically to changing load requirements. Its design provides maximum efficiency under full and partial load conditions—results in low power consumption, economical operation. And the new Absorption Cold Generator is *quiet*, vibration-free—may be located anywhere without sound-proofing the area. Single-shell construction reduces overall size, permits installation in areas with low ceilings. Factory-assembled and wired, it has been designed to effect substantial savings in installation time and costs. Twelve sizes from 100 to 530 tons permit selection of a unit to match the exact cooling requirements.

The TRANE Company has extensively tested and proven this new *hermetic* absorption water chiller design assuring dependable, economical water or other liquid chilling for a wide variety of applications; and it will minimize operation and maintenance problems.

WANT MORE FACTS? For complete information on the new TRANE Hermetic Absorption Cold Generator, just call your nearby TRANE Sales Office; or write TRANE, La Crosse, Wisconsin.

For any air condition, turn to

TRANE

MANUFACTURING ENGINEERS OF AIR CONDITIONING, HEATING, VENTILATING AND HEAT TRANSFER EQUIPMENT

THE TRANE COMPANY, LA CROSSE, WIS. • SCRANTON MFG. DIV., SCRANTON, PA. • CLARKSVILLE MFG. DIV., CLARKSVILLE, TENN. • TRANE COMPANY OF CANADA, LIMITED, TORONTO • 100 U.S. AND 19 CANADIAN OFFICES

New Heat Pump is compact, efficient, designed for in-the-room or remote installation. 3 to 15-ton capacities for industrial or commercial applications. Easily accessible piping and connections simplify installation. Compact water to air unit takes little floor space. Refrigeration cycle removable.

New Climate Changers heat, cool, ventilate . . . solve a wide variety of application problems. Single-zone and multi-zone units that supply different air conditions for as many as 14 zones at the same time. New design features reduce overall costs. 1200 to 47,000 cfm.

This mark tells you a product is made of modern, dependable Steel

"We have yet to find anything better than our National Tube Distributor's service — their deliveries are faster than anyone else's."

"Our profit margin would go to pot if we couldn't depend on rapid delivery at short notice," said Mr. Arthur L. Lewis, President of Lewis Mechanical Contractors, Inc., Middletown, Pa. "We specialize in contracting for government projects which usually begin on short notice. That's why we buy 95% of our pipe from National Tube. When our distributor, The Bodwell Company, promises a delivery, that's just what we get. They deliver pipe—not excuses.

"We were working on a tight schedule on an Air Force Base near here and needed two carloads of

wrapped pipe. Our distributor delivered USS National Pipe on time—in about half the time promised by competitive firms which permitted us to start on schedule. We also know that our National Tube Distributor keeps a large stock of pipe on hand to meet emergencies—we can obtain any size from ⅛ inch to 24 inches.

"Government specifications are rigid but National Tube salesmen and distributors are always ready to help us. We usually call them in to help draw up the order and offer recommendations. Their advice and technical assistance are invaluable.

"We have found USS National Pipe, as delivered on any job, gives us consistent dependability, uniform performance and better fit for welding. This virtually eliminates our fitting problems.

"Our dealing with National Tube and their distributors is like having an extra man on the job. And at no extra cost. We know help is as close as our telephone. We have yet to find better service anywhere.

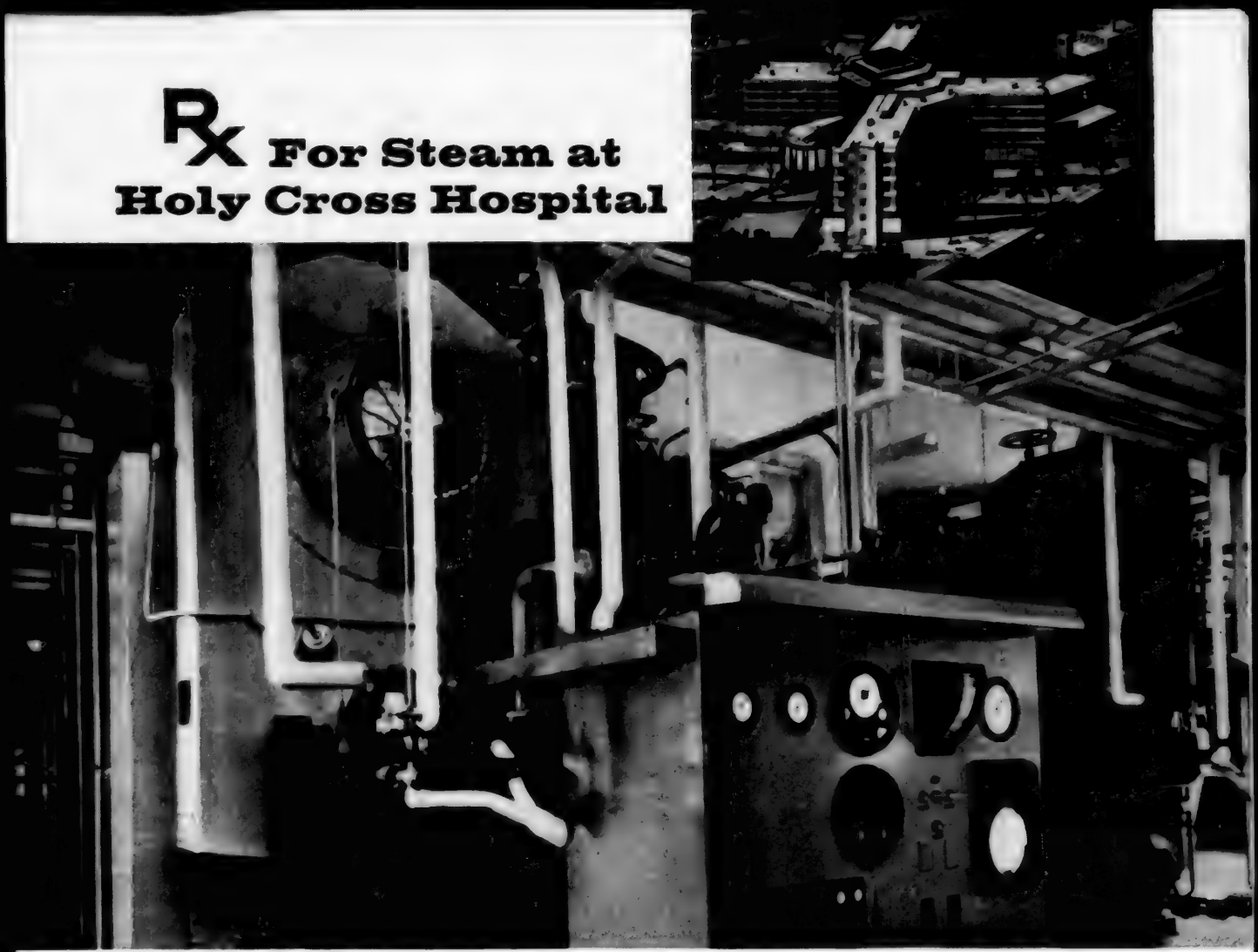
USS and National are registered trademarks

USS

National Tube Division of United States Steel

Columbia-Geneva Steel Division, San Francisco, Pacific Coast Distributors
United States Steel Export Company, New York

Rx For Steam at Holy Cross Hospital



Two new oil and gas-fired B&W Package Units dependably meet crucial 40,000-lb-per-hour steam requirement at well known Chicago hospital

Day after day, year after year, each and every hospital activity is vital. This continuous, reliable hospital service must, of course, be supported by absolute dependability in equipment.

That's why so many institutions such as Chicago's Holy Cross Hospital have selected B&W Package Boilers to meet their steam requirements. Supplying clean, dry steam for critical uses such as heating, laundry, kitchens and sterilizers, B&W Package Boilers have become a standard of dependability in hospitals and other institutions throughout the nation.

Dependability, however, is only part of the story. Budget-minded hospital management has found the low maintenance, cleanliness of operation, high operating economies, flexibility, rapid response to demand, and maximum capacity in minimum space afforded by B&W shop-assembled units equally attractive features. What's more, they appreciate the assurance that at any time during the life of the boiler, even 20 or 30 years hence, B&W's nationwide service organization will be promptly and economically available if needed.

Serving the myriad steam requirements of a vital installation like Chicago's Holy Cross Hospital is further evidence in action of dependable steam generation by B&W. Whatever *your* steam requirements... whatever your most economical fuel... B&W has the boiler best suited to your application. Your local B&W representative has all the facts on your area. Please call him soon. The Babcock & Wilcox Company, Boiler Division, Barberton, Ohio.

B&W — THE NATION'S LEADING MANUFACTURER OF INDUSTRIAL BOILERS

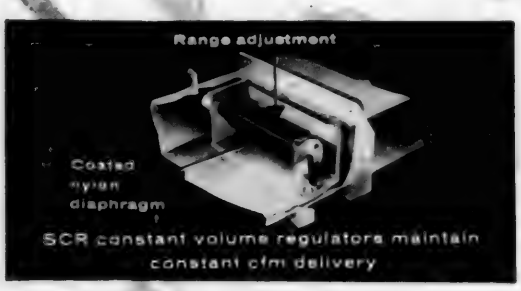
G-981 A-1B

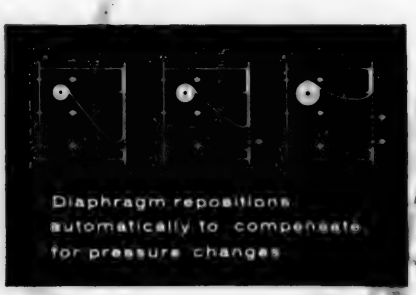
B&W

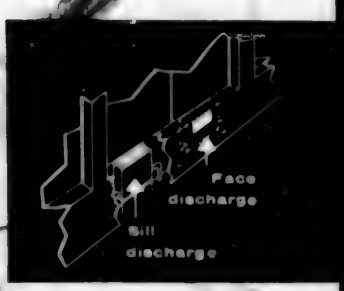
THE BABCOCK & WILCOX COMPANY

BOILER DIVISION

How to harness high







velocity air

High velocity air distribution has won its spurs. Its growing use is a reflection of the important space and material costsavings which it makes possible in new construction — plus the flexibility and cost-reducing simplification which the smaller duct sizes bring about on modernization jobs.

At the same time, high velocity systems have confronted engineers with new requirements in system design and stabilization, as well as in selection and application of air distribution equipment. The problems are different than in conventional systems, but they need not be more difficult.

For over ten years Barber-Colman has conducted extensive research, testing, and development work on high velocity systems — with a resultant wealth of valuable data, plus important new high velocity air distribution products.

Barber-Colman air valves and constant volume regulators greatly simplify the design and stabilization of systems. They provide accurate, dependable means for reducing high velocities to conventional velocities, controlling hot and cold air mixing, and maintaining constant cfm delivery.

For real help on high velocity, ask for Barber-Colman's 52-page High Velocity Data File.

See our exhibit
Booth No. 506-508
International Heating &
Air-Conditioning Exposition
Chicago, Feb. 13-16.

Single- and double-duct control units for under-window installation — sill or front discharge

BARBER COLMAN

BARBER-COLMAN COMPANY
Dept. L, 1102 Rock Street, Rockford, Illinois

Bethcon galvanized steel sheets permit long spans, minimum supports

Strong and rigid—because they're steel—Bethcon galvanized sheets form up into strong and rigid ductwork which requires a minimum number of supporting brackets.

In addition, a Bethcon galvanized steel sheet is just right for easy shopwork . . . not too hard, not too soft. That's because we use a special annealing cycle which gives the sheet an ideal balance of ductility and strength.

Bethcon's zinc coating is second to none for its refusal to flake or peel off. Bethlehem's continuous galvanizing process bonds zinc to steel so tightly that even when the sheet is doubled back on itself, the coating stays put. Hemming without puckering or wrinkling is no problem with Bethcon sheets.

You can specify Bethcon galvanized sheets in a wide variety of gages, with either plain open-hearth or copper-bearing (Beth-Cu-Loy) steel for the base metal. We'll be glad to furnish any details you need. Just get in touch with our nearest sales office.

Galvanized Steel

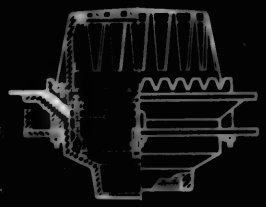
for Strength
. . . Economy
. . . Versatility

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.
Export Sales: Bethlehem Steel Export Corporation

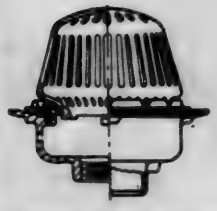
BETHLEHEM STEEL

BETHLEHEM STEEL

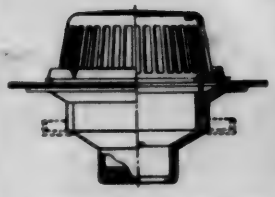
THE BASIC ROOF DRAIN:



WADE



BRAND "Z"



BRAND "S"

		WADE	BRAND "Z"	BRAND "S"
Flange Diameters	2" Outlet	16⅜"	16"	16"
	3" Outlet	16⅜"	16"	16"
	4" Outlet	16⅜"	16"	16"
	5" Outlet	18½"	16"	16"
	6" Outlet	18½"	16"	16"
	8" Outlet	19½"	16"	—
Cross Sectional Area Ratios Sump to Downspout	2" Outlet	25 to 1	30.2 to 1	17.5 to 1
	3" Outlet	10 to 1	12.2 to 1	7.05 to 1
	4" Outlet	6.25 to 1	7.56 to 1	4.38 to 1
	5" Outlet	5.06 to 1	4.84 to 1	2.8 to 1
	6" Outlet	3.52 to 1	3.36 to 1	1.95 to 1
	8" Outlet	2.64 to 1	1.89 to 1	——
Dome Diameters	2" Outlet	10⅞"	11½"	11½"
	3" Outlet	10⅞"	11½"	11½"
	4" Outlet	10⅞"	11½"	11½"
	5" Outlet	12⅞"	11½"	11½"
	6" Outlet	12⅞"	11½"	11½"
	8" Outlet	14¼"	11½"	——
Weight in Pounds	2" Outlet	49	49	42
	3" Outlet	46	49	42
	4" Outlet	47	49	42
	5" Outlet	62	50	65
	6" Outlet	62	51	66
	8" Outlet	65	52	——
Means of Securing Flashing Ring		Brass Hinged Clamping Units Secured to Body	Clamping Bolts (Loose)	Clamping Bolts (Loose)

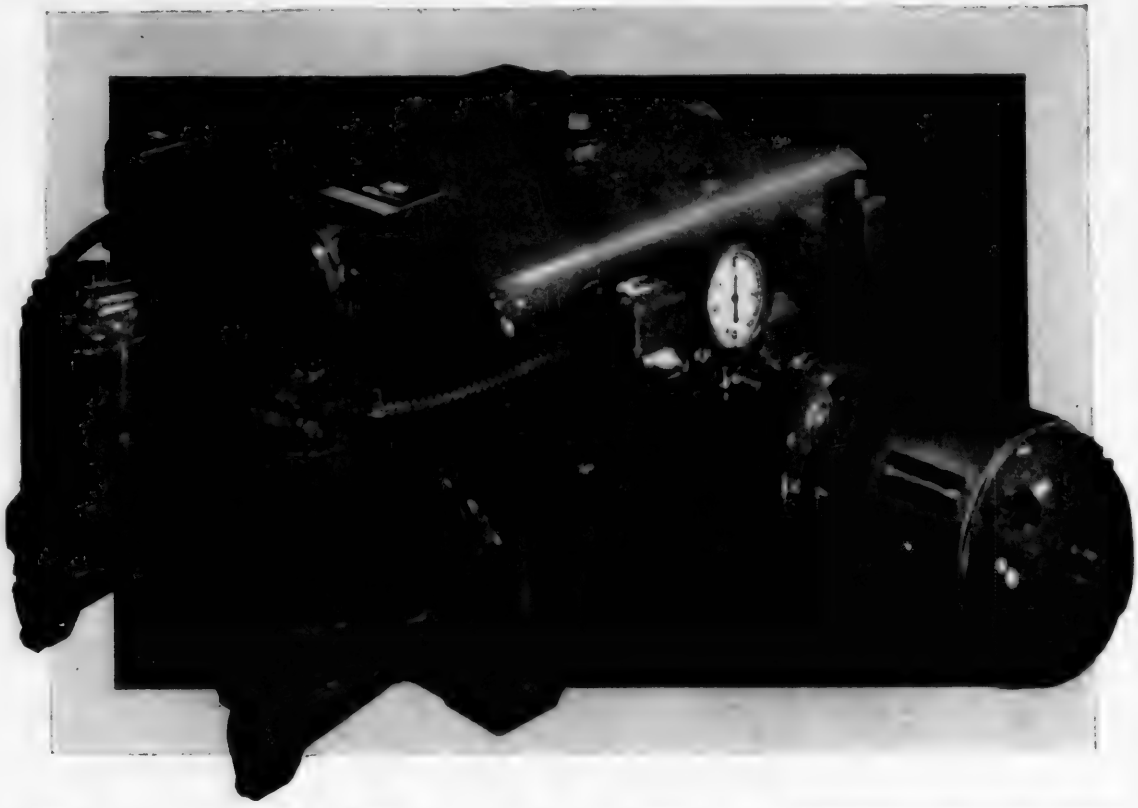
NOTE: Drain comparison data based on manufacturers' published literature and on product samples purchased on the market.

"...in fact... Wade has no equal!"

WADE

WADE MANUFACTURING COMPANY
ELGIN, ILLINOIS

THIS NEW VACUUM HEATING PUMP IS SIZED TO ACTUAL JOB REQUIREMENTS



It's the Nash CSM

No longer is it necessary for the Engineer to accept a vacuum heating pump with air and water capacities based inflexibly upon square feet of equivalent direct radiation. With the flexible Nash CSM he can provide for proper air capacity in accordance with his judgment and experience. For the individual capacities of the separate pumps on the CSM may be varied within a wide range, without buying an oversize receiver and oversize water pumps.

These pumps possess many other features which permit a more efficient utilization of fuel and minimum use of electric power. Low, low, returns reduce installation costs and usually eliminate putting the pump in a pit. Simplicity and efficient operation reduce supervision and maintenance costs. Information regarding this new heating pump development is available immediately upon request.

- Increased air capacity induces rapid system response without wasteful overheating.
- Separate air and water pumps individually selected to meet actual job requirements.
- Control system that operates individual pumps only when needed.
- Flexibility permitting addition of radiation without changing basic pump installation.
- Low, low, return line connection.

NASH ENGINEERING COMPANY
438 WILSON, SO. NORWALK, CONN.

Absence of a tall, unsightly chimney at new Vandalia Elementary School, in Greensboro, N. C., contributes to pleasing exterior lines of the building. A draft inducer and an unobtrusive stub stack eliminated tall stack, yet assure steady, reliable draft. Here is a procedure to facilitate

Selection of Induced Draft Fans For Heating Boilers

H. A. REYNOLDS
Technical Representative
L. J. Wing Mfg. Co., Linden, N. J.

IN THE PROCESS OF SELECTING induced draft fans for thousands of conventional steel and cast iron heating boilers, it has been necessary to evolve fast, simplified procedures that will result in adequate fan capacities, with margin for unforeseen conditions but avoiding foolish excesses of capacity for both engineering and competitive reasons. A discussion of this method may be useful in understanding why induced draft fans are needed, as well as aiding in the determination of fan requirements for heating boiler service, when there is an existing stack to be utilized or where the stack recommended by the boiler manufacturer can not be used for some reason such as the desire to avoid a tall stack.

The first step is to tabulate conditions applying to the specific installation. Necessary data will include the required firing rate; furnace draft and boiler draft loss requirements; the length, area and turns in the breeching; the height and area of the chimney; and the elevation of the installation above sea level. For the sake of brevity, this discussion will be confined to installations at approximately sea level.

For the succeeding steps, the procedure can become quite technical, with precise calculations of gas temperatures, friction losses and stack effect. However, such calculations require established outdoor weather conditions, assume a fixed adjustment of the burner at constant CO_2, and assume that the boiler is in a constant state of cleanliness. Actually, these and other factors vary because of the seasons, because of rain, snow and wind, because of the human element in adjusting the burner, and because deposits accumulate in the boiler, at varying rates, with the passage of time. It is therefore more realistic and far quicker to

base selection of the fan on a few empirical capacity and friction factors reasonably conditioned to compensate for untoward burner adjustments, leakage, dirty boilers, poorly constructed flues and unfavorable weather conditions.

The next step is to establish the quantity of flue gas to be handled by the fan. In actual practice, this may run around 60-65 cfm per gph of oil firing rate, but experience on hundreds of installations indicates that a higher factor should be used as a basis for fan selection. A quantity of 75-80 cfm per gph of oil has been found to give excellent results in fan selection. While some combustion engineers may tie this to a given percentage of excess air and CO_2, to do so would assume fixed gas temperatures and overlook leakages external to the boiler, so this factor is completely empirical.

To determine the furnace draft requirement, a figure of 0.02 inches is used for gun-type burners, or 0.12 inches for rotary burners. But since the boiler draft loss is not included in most conventional published data, another approach is to base selection on the chimney height recommended for natural draft. This figure is carried on most heating boiler data sheets and is based on providing sufficient draft for friction through the boiler and operating draft at the burner.

We find that the draft to be expected from a masonry stack, in inches of water referred to standard air density, is an amount slightly less than its height in feet divided by 100. This rule is based on an average stack gas temperature of 300 deg F. A 50-ft stack thus provides draft equivalent to about 0.48 inches, and a 100-ft stack to about 0.97 inches. After correcting for friction loss in the stack, this rule of thumb converts the manufacturer's recommended stack height into equivalent draft required at the boiler uptake. It is next necessary to compare this with the draft developed by the existing or proposed new stack or chimney, known as the stack assist. This is determined in the same manner: dividing the stack height by 100 and deducting friction losses. Friction losses may be taken from Table 1 or they may be calculated.

Examination of stack areas recommended by boiler manufacturers will show that these are such as to produce very low but none-the-less measurable friction losses. Stack area must be enough to minimize frictional reduction of the natural draft effect. But if the area is too great, the hot gases will tend to rise up the center of the stack instead of filling the entire stack. This leaves a layer of stagnant, cool gas near the walls of the chimney, with the result that the chimney is not heated properly. Stacks with excessive area, therefore, do not produce draft in the amount theoretically to be expected from their height.

Properly-designed natural draft stacks generally will have gas velocities associated with a friction loss of about 0.03-0.06 inches. Existing stack areas may be such that the friction loss will be far more, or else immeasurable. Simply because the friction loss calculation is lower than "normal" does not mean that some "free" draft assistance is available; it is actually a danger sign and one of the principal reasons why fans frequently must be applied to very tall chimneys that would seem to have more than adequate height.

For chimneys having cross-sectional area less than that recommended, friction must be evaluated with care and judgment. Up to a certain point, the velocity will be such that frictional resistance will be less than the natural draft effect of the stack. So long as this condition is not upset, the entire stack will be under negative pressure with all infiltration inward.

However, once the velocity becomes sufficient to establish frictional resistance in excess of the natural draft effect, a positive pressure must exist in the stack. With this condition, all leakage is outward and the exterior walls of the stack become much hotter. This promotes problems of gas leakage at cleanout doors,

TABLE I—FRICTION LOSS OF FLUE GASES IN ROUND AND RECTANGULAR FLUES

Volume of Gas at 600 Deg F. in Cfm	Inside Diameter, Inches (top) and Equivalent Area, Square Inches (bottom)																	
	7	8	9	10	12	14	16	18	20	22	24	25	26	28	30	32	34	36
	39	50	64	78	113	153	201	254	314	380	452	500	531	616	707	804	908	1018
	Friction Loss in Inches of Water per 100 Ft of Breeching or Chimney Travel (Corrected to 70 Deg F)																	
300	.50	.32	.16	.09	—	—	—	—	—	—	—	—	—	—	—	—	—	—
400	.81	.50	.25	.15	.06	—	—	—	—	—	—	—	—	—	—	—	—	—
500	1.63	.69	.38	.22	.09	.04	—	—	—	—	—	—	—	—	—	—	—	—
700	2.50	1.25	.75	.40	.17	.08	.04	—	—	—	—	—	—	—	—	—	—	—
800	3.50	1.88	.87	.55	.21	.10	.05	—	—	—	—	—	—	—	—	—	—	—
1000	5.00	2.63	1.50	.88	.33	.16	.08	.04	—	—	—	—	—	—	—	—	—	—
1500	—	5.60	3.00	1.87	.71	.31	.16	.09	.06	—	—	—	—	—	—	—	—	—
2000	—	—	5.00	3.13	1.25	.55	.26	.16	.09	.06	—	—	—	—	—	—	—	—
2500	—	—	7.50	4.38	1.88	.81	.43	.24	.15	.09	.06	—	—	—	—	—	—	—
3000	—	—	—	6.25	2.50	1.06	.60	.33	.20	.13	.08	.07	.06	—	—	—	—	—
3500	—	—	—	8.75	3.40	1.50	.79	.44	.25	.16	.10	.08	.07	.05	—	—	—	—
4000	—	—	—	—	4.25	2.00	1.00	.56	.33	.21	.14	.11	.09	.06	.05	—	—	—
4500	—	—	—	—	5.38	2.50	1.25	.70	.41	.26	.18	.14	.12	.08	.06	—	—	—
5000	—	—	—	—	6.64	3.13	1.63	.84	.50	.30	.21	.18	.14	.10	.07	.05	—	—
5500	—	—	—	—	8.10	3.75	1.88	1.00	.60	.38	.25	.21	.16	.12	.08	.06	—	—
6000	—	—	—	—	—	4.50	2.25	1.20	.73	.46	.30	.25	.20	.15	.10	.07	.05	—
7000	—	—	—	—	—	5.65	3.00	1.62	.94	.59	.38	.34	.25	.19	.13	.09	.07	.05
8000	—	—	—	—	—	7.50	3.76	2.10	1.20	.75	.50	.43	.33	.23	.16	.12	.09	.06
10000	—	—	—	—	—	—	5.60	3.10	1.90	1.10	.75	.63	.50	.35	.25	.18	.14	.10
12000	—	—	—	—	—	—	8.10	4.40	2.60	1.63	1.06	.88	.71	.50	.36	.25	.19	.14

Note: For rectangular flues, find area in square inches and use column whose equivalent area corresponds.

at the flue connection to the stack, at incinerator connections, and "back" through idle boilers. For internal chimneys, as in apartment houses, the walls adjacent to the chimney can become abnormally hot, giving difficulty in the control of heat. And, if wood is close to the chimney masonry, cracks may lead to fires.

It is not wise to carry the velocity up to a point approaching the pressurizing velocity, as allowance must be made for the puff from burner ignition. In many cases, this releases an abnormal rush of flue gas, giving high velocities for a brief period of a second or two. Properly-engineered installations handle this without difficulty, whereas considerable annoyance from momentary gas and soot leaks can develop where normal velocities are close to the pressurizing velocity.

Sample Calculation to Determine Fan Capacity and Pressure

Boiler firing rate: 50 gph
Recommended stack: 100 ft height
30 inch diameter
Existing: 30 ft stack
20 ft of breeching
24 inch stack and breeching diameter

1. Required fan capacity (gph × 80)
   50 · 80 — *4000 cfm*
2. Equivalent net recommended stack effect (Slightly less than height/100 — friction losses)
   100-ft stack: 0.97 inches
   Friction loss from 4000 cfm in 100 ft of 30-inch stack:
   From Table 1, find 0.05 inches
   0.97 — 0.05 = *0.92 inches*
3. Equivalent net stack assist from existing chimney
   (Slightly less than height/100 — friction loss)
   30-ft stack: 0.29 inches
   Loss from 4000 cfm in 30 ft of 24-inch stack:
   30/100 × 0.14 = *0.04 inches*
   0.29 — 0.04 = *0.25 inches*
4. Additional friction loss due to undersize breeching
   Loss in 20 ft of 24-inch breeching at 4000 cfm:
   20/100 × 0.14 = *0.03 inches*
   Loss in 20 ft of 30-inch breeching at 4000 cfm:
   20/100 × 0.05 = *0.01 inches*
   0.03 — 0.01 = *0.02 inches*
5. Net fan requirement
   (Recommended stack — existing stack + undersize breeching loss)
   0.92 — 0.25 + 0.02 = *0.69 inches*

Fig. 1. Draft inducer is shown installed in the breeching between the boiler and stack in a vertical-up discharge position at Vandalia Elementary School. Photo, L. J. Wing.

In general, therefore, it is wise to avoid gas velocities much over double those recommended for natural draft. Referring to friction charts based on standard air, pressurizing of the stack occurs when the velocities become such that the rate of frictional resistance reaches one inch per 100 ft. As a general rule, it is well to stay under 0.15-0.20 inches per 100 ft in using standard air data, which is equivalent to velocities of about 1000 fpm for very small boilers and 1500 fpm for medium size units. In special cases (stacks standing separate from the building with special provisions for entrance of gases to stack), rates as high as 0.40 inches per 100 ft have been used successfully.

When it is determined that the friction loss rate is satisfactorily below the pressurizing condition, the friction loss is deducted from the natural stack effect produced by the existing chimney, giving the net draft effect at the base. If the breechings in the boiler room are of smaller cross-sectional area than those recommended for natural draft, the same consideration must be given to the problem of avoiding positive pressures and to calculation of friction losses.

Now, by taking the equivalent stack effect recommended for natural draft, subtracting the net draft effect at the base of the existing stack, and adding the amount of any breeching friction over and above the loss in breechings of the size recommended for natural draft, the net requirement for additional draft is developed. Pairing this with the cubic feet per minute of flue gas to be handled gives the data necessary for selection of the induced draft fan. Since all work is based on standard air conditions to eliminate any specific gas temperature from consideration, these data can now be used with standard fan test data without further correction for density.

The accompanying example assumes a boiler is to be fired at 50 gph. The manufacturer recommends a stack 100 ft high and 30 inches in diameter. The existing breeching and stack are only 24 inches in diameter, with 20 ft of breeching and 30 ft of stack. The calculations show 0.69 inches net fan requirement. The fan would, therefore, be selected for 4000 cfm at 0.69 inches static pressure.

New Data Simplify

Residential Cooling Load Calculation

Of all the problems that have bothered the air conditioning industry, one of the most persistent has been the lack of a single, all-industry heat gain calculation method. Now, after months of study, the solution to this difficult problem is well on its way toward industry-wide acceptance.

AT PRESENT THERE ARE THREE INDUSTRY METHODS for calculating the heat gain of a house for the design of a central cooling system—set forth by National Warm Air Heating and Air Conditioning Association (NWAHACA), Air-Conditioning and Refrigeration Institute (ARI), and Institute of Boiler and Radiator Manufacturers (I-B-R)—together with a selection of various company-propounded methods, all acceptable by the Federal Housing Administration.

However, heat gain totals produced by each of these methods have had no agreement with one another. The result has been a disparity in comparative bidding which has been a thorn in the side of FHA, mortgage lenders, and industry people alike.

Demonstrative of this problem was a typical case cited by the Los Angeles office of FHA in which the heat gain for one house, calculated according to the three industry-propounded methods, ranged from 33,000 to 60,000 Btuh.

Accordingly, FHA asked NWAHACA to explore what could be accomplished to resolve this wide diversity in heat gain calculation methods.

Herbert T. Gilkey, Director of Technical Services, NWAHACA, presented the problem before the Association's Air Conditioning Load Calculation Committee which sent invitations to ARI and I-B-R, who also had been warned by FHA that unless the entire industry developed a single method of calculation that the government might have to act on its own.

From its first meeting, September 29, 1959, a special Industry Heat Gain Joint Study Group has worked continuously on this project. Working with this subcommittee were two engineers responsible for industry research at the University of Illinois, Edward J. Brown of the National Warm Air Heating and Air Conditioning Association research program and Prof. Warren E. Harris of the I-B-R projects. They analyzed data and results obtained from the three NWAHACA research residences and the two research houses owned by I-B-R.

The following has been extracted from their report. The final report of the sub-committee has been accepted by the Joint Industry Committee and the "unified" calculation procedure has now been referred to all three trade associations for their consideration.

Target date for publication by the three groups is early 1961.

Diurnal Temperature Range Assumed 20 Degrees

Cooling load calculation procedures in the residential field are basically for sensible load with allowances for latent and internal load. The present investigation deals with sensible load only.

Adequate design procedure is based on the assumption of inside dry-bulb of 75 deg F. Equipment selected on the basis of design loads should be adequate to maintain indoor design temperatures within normal thermostatic control tolerances during a design day and at the same time operate more or less continuously during the daylight hours.

It was found that a daily outdoor temperature range of 20 deg could be used regardless of outside design dry bulb temperature.

Eight-Hour Design Period Chosen

The five research houses used present a wide variety of constructions. One is fully insulated and tightly constructed, another is the opposite, for instance. In all of them, heat flow rates through its various components are affected by construction and orientation and maximum loads do not occur simultaneously. However, for design purposes it was found that the eight-hour period from 11:00 a.m. to 7:00 p.m. could be

TABLE 1—HEAT GAIN FACTORS

Source of Heat	U Factor, Btu per (hr) (Sq Ft) (deg F)	Maximum Outdoor Temperature, Deg F					
		90	95	100	90	95	100
		Equivalent Temperature Difference, Deg F			Heat Gain Factor, Btu per (hr) (sq ft)		
WALLS AND DOORS							
Frame and veneer on frame							
No insulation	.26	18.6	23.6	28.6	4.8	6.1	7.4
Less than 1-inch insulation, or one reflective air space	.19	18.6	23.6	28.6	3.5	4.5	5.4
1-2-inch insulation, or two reflective air spaces	.13	18.6	23.6	28.6	2.4	3.1	3.7
More than 2-inch insulation, or three reflective air spaces	.08	18.6	23.6	28.6	1.5	1.9	2.3
Masonry, 8-inch block or brick							
Plastered or plain	.48	11.3	16.3	21.3	5.4	7.8	10.2
Furred, no insulation	.30	11.3	16.3	21.3	3.4	4.9	6.4
Furred, with less than 1-inch insulation, or one reflective air space	.20	11.3	16.3	21.3	2.3	3.3	4.3
Furred, with 1-2-inch insulation, or two reflective air spaces	.14	11.3	16.3	21.3	1.5	2.3	3.0
Furred, with more than 2-inch insulation, or three reflective air spaces	.09	11.3	16.3	21.3	1.0	1.5	1.9
Partitions							
Frame, finished one side only, no insulation	.60	10.0	15.0	20.0	6.0	9.0	12.0
Frame, finished both sides, no insulation	.34	10.0	15.0	20.0	3.4	5.1	6.8
Frame, finished both sides, more than 1-inch insulation or two reflective air spaces	.14	10.0	15.0	20.0	1.4	2.1	2.8
Masonry, plastered one side, no insulation	.35	3.5	8.5	13.5	1.2	3.0	4.7
Doors, wood	.50	18.6	23.6	28.6	9.3	11.8	14.3
Doors, glass		(Treat glass doors same as windows)					
CEILINGS AND ROOFS							
Ceilings under naturally vented attic or vented flat roof	U_c* / U_c**						
Uninsulated	.23 / .44	39.0	44.0	49.0	9.0	10.2	11.3
Less than 2-inch insulation or one reflective air space	.10 / .13	39.0	44.0	49.0	3.9	4.4	4.9
2-4-inch insulation or two reflective air spaces	.06 / .075	39.0	44.0	49.0	2.3	2.6	2.9
More than 4-inch insulation or three or more reflective air spaces	.04 / .045	39.0	44.0	49.0	1.6	1.8	2.0
Built-up roof, no ceiling							
Uninsulated	.40	39.0	44.0	49.0	15.6	17.6	19.6
2-inch insulation	.20	39.0	44.0	49.0	7.8	8.8	9.8
3-inch insulation	.14	39.0	44.0	49.0	5.5	6.2	6.9
Ceilings under unconditioned rooms	.19	10.0	15.0	20.0	1.9	2.9	3.8
FLOORS							
Over unconditioned rooms	.24	10.0	15.0	20.0	2.4	3.6	4.8
Over basement, enclosed crawl space, or slab on ground	0	0	0	0	0	0	0
Over open crawl space	.34	10.0	15.0	20.0	3.4	5.1	6.8
INFILTRATION, Btuh per sq ft, gross exposed wall		½ air change			0.97	1.30	1.62

* Thermal conductivity of roof-ceiling combination, from Guide. (Multiply by ETD to obtain heat gain factor)
** Thermal conductivity of ceiling only, calculated.

used to determine average heat transmission factors to be used for wall constructions.

Sensible heat gain through a wall is defined by the equation

$$H = A \times U \times ETD$$

where

H = Sensible heat gain through wall, Btuh,

A = Wall area, sq ft,

ETD = Equivalent temperature difference, a value used in place of outdoor-indoor temperature difference when estimating heat gains through walls. Equivalent temperature difference is adjusted to compensate for solar radiation effects.

U = Coefficient of heat transfer, Btuh per (sq ft) (deg F).

TABLE 2—GLASS FACTORS

(For 30° and 40° North Latitude Only)

Shading and Orientation	Maximum Outdoor Temperature, Deg F					
	90	95	100	90	95	100
	Heat Gain Factors, Btu per (Hr)(Sq Ft)					
	Single Glass			Double Glass		
NO INSIDE SHADES						
N. (or shaded)*	26	31	36	19	21	24
N.E. and N.W.	58	63	68	43	45	48
E. and W.	84	89	94	61	64	66
S.E. and S.W.	73	78	83	72	75	77
S.	43	48	53	34	37	39
SHADES HALF DRAWN						
N. (or shaded)	23	27	31	16	18	20
N.E. and N.W.	49	53	57	36	37	40
E. and W.	70	74	78	50	53	54
S.E. and S.W.	61	65	69	59	62	63
S.	37	41	45	29	31	33
INSIDE VENETIAN BLINDS OR DRAPES						
N. (or shaded)	20	23	26	14	16	18
N.E. and N.W.	41	44	47	30	31	34
E. and W.	58	61	64	42	44	45
S.E. and S.W.	50	54	57	49	51	52
S.	31	34	37	24	26	27
AWNINGS OR OUTSIDE SHADE SCREENS						
N. (or shaded)	14	16	18	10	10	11
N.E. and N.W.	26	28	30	18	19	20
E. and W.	35	37	39	24	25	26
S.E. and S.W.	32	33	35	28	29	30
S.	20	23	25	15	16	17

* Permanent shading, such as roof overhang, adjacent buildings, etc.

The data in Tables 1 and 2 are based on ASHRAE *Guide* data that have been averaged out and about which simplifying assumptions have been made. For instance, to derive equivalent temperature differentials for frame and veneer walls, the following was done:

Using Table 10, page 192, 1960 ASHRAE *Guide*, all tabulated values of equivalent temperature differences for dark walls in the sections headed "frame" and "4 in. brick or stone veneer and frame" between 11:00 a.m. and 7:00 p.m. and without regard to orientation were averaged together, and corrected as directed in footnotes to the table to outdoor-indoor temperature differences of 15, 20, and 25 deg (outdoor temperatures of 90, 95, and 100 deg and an indoor temperature of 75 deg). Dark wall equivalent temperature differences were used since the designer does not always know the wall color and dark wall values result in safe heat gain factors.

Heat gain factors of Table 1 are the products of U values and derived equivalent temperature differentials, as therein tabulated. Comparison of actual heat gains of the research residences with those calculated with the new design factors showed that the two were in very close agreement. Since the five research houses represent a wide variety of constructions, it is believed by Messrs. Harris and Brown that use of the new heat gain factors is warranted in the sizing of air conditioning equipment for any house of contemporary design.

Three Manuals Will Be Superseded

When and if the several trade associations have accepted the report of the Joint Industry Committee with its unified calculation procedure, as outlined above, the following publications, now widely used will be superseded:

Manual No. 11, "Design and Installation of Summer Air Conditioning for New and Existing Residences," 4th ed. (National Warm Air Heating and Air Conditioning Association, Cleveland, 1959.)

Guide C-30, "I-B-R Cooling Load Calculation Guide," 1st ed. (The Institute of Boiler and Radiator Manufacturers, New York, 1956.)

Year-Round Residential Air-Conditioning, "Standard 230-57," (Air-Conditioning and Refrigeration Institute, Washington, D. C., 1957.)

In addition, many installation and application manuals published by residential air conditioning manufacturers will have to be revised.

Recirculating Water Systems and Mechanical Pump Seals

DONALD B. GARDNER
Bell & Gossett Co., Morton Grove, Ill.

The performance of mechanical pump seals can be controlled by certain application and installation procedures which can be utilized in both closed and open recirculating water systems.

A CLOSED recirculating water system, whether it be hot or chilled water by definition, has insignificant losses of fluid or cushion air. To accomplish this fact by design, only mechanical seal pumps can be used. Furthermore, it is necessary that the system be so designed that normal operation will not cause air or fluid to be taken in or expelled. An occurrence of this nature must only be for *emergency, safety,* or *repair purposes.* Modern design methods can guarantee that there will be no intake of air into the closed system and no significant losses of water, thus keeping the system in a balance that will permit it to remain sealed or intact for years. The ratio of water volume to air (gas) cushion remains constant.

Naturally these modern systems most nearly approach the ideal as they cannot corrode nor accumulate scale. The system is preserved through mechanical design by excluding the causes of system deterioration. One nationally-known figure in hot water heating has stated that there never has been a properly designed closed hot water system that ever corroded internally.

Statistically since 1938 there have been made between one and two million such pump installations on the Atlantic seaboard from Boston to Washington, and approximately one-third as many in the Philadelphia area. Also, a minimum of another million throughout the United States. They are successful in spite of the fact that, in most cases, there was provided only a minimum of system preparation.

A new system installation will be better if cleaned to remove pipe dope, slushing compounds, cutting oils, welding slag, and other extraneous materials that can find their way into the system during construction. Many commercial boiler cleaning compounds are satisfactory, providing they are adequately flushed out. Trisodium phosphate, sodium carbonate, and many of the commercial detergents also are satisfactory when used in the same manner. Following the cleaning and flushing (drain or blow-down valves must be large enough for adequate purging), the system should be definitely neutral. To assure this, enough of the cleaning material can be added after refilling to give a plus alkalinity; a good figure is a pH between 7.5 and 9.

Seal failures occurring within the first two years of operation in closed systems of this type, while avoidable, are usually due to one or more of the following conditions:

1. Excessive dirt, sand, and oxides
2. Excessive or improper water treatment
3. Pump cavitation (improper pump selection)
4. Air
5. Excessive temperatures
6. Pumps run without fluid

The function of a pump seal prevents any fluid leakage by having two matched optically flat or mated faces, one stationary, and one that rotates with the pump shaft. Machining procedures of the larger pump manufacturers are such that misalignment of the seal parts is practically non-existent. The average heating-cooling system seal uses a carbon ring rotating against a hard material. The choice of hard material varies with the manufacturer. The most popular, in order of preference, are cast iron, ceramic, and tungsten carbide. The carbon ring always shows the greatest amount of wear, it being the softer of the two.

Actually the pump manufacturer selects the seal materials to suit the condition under which the seal is to operate. He should know the type of fluid, temperature range, and working pressures for special applications. Usually for most systems, especially those discussed in this article, only standard production seals are used which are satisfactory for relatively clean water from 35 to 225 deg F, with a top operating pressure of 125 psi. This temperature range may widen or decrease slightly depending on the individual manufacturer.

Figure 1 shows a carbon seal ring before use, Fig. 2 is a worn carbon ring, and Fig. 3 is the mating ceramic ring to the carbon ring in Fig. 2. This carbon ring failed in a closed system after six months of operation. The system contained large quantities of iron oxide and considerable sand which entered the system during construction. Solids entrained in the fluid flow do cause rapid erosion of the seal parts if they are of a size small enough to find their way be-

tween the seal surfaces. The system was flushed out with a cleaner, then refilled and enough cleaner added to raise the pH to 8. No further trouble has been experienced in the past two years.

A closed system sometimes is treated for corrosion prevention with chromates. It has been found from field experience, as well as from laboratory tests reported by one of the largest seal manufacturers in the United States, that seal wear is also directly proportional to the chromate concentration in the system. Well-known national water treatment organizations indicate that adequate protection for systems as defined in this article is obtained with a maximum of

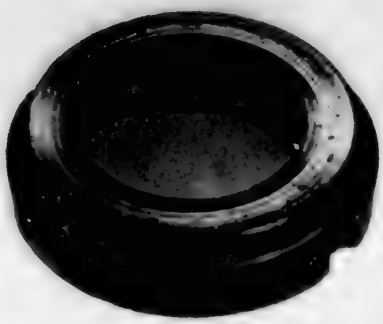


Fig. 4. Carbon ring wear pattern due to crystal erosion.

250-300 ppm of chromates. This level is also compatible with good seal operation and life.

A contractor installed a group of 200 boilers and through a misunderstanding treatment was provided in 75 of the 200 closed hot water installations. This contractor advises that all 75 treated systems had pump seal failures due to the chromate treatment which ranged from 2000 to 3000 ppm. After flushing out the systems no further seal failures have occurred in the past three years. The systems with no treatment have also been satisfactory for the past four years. Chromates, as well as sodium tetrasilicate (waterglass) in high concentrations, form crystals between the mating faces, causing rapid erosion of the parts and leakage to occur prematurely. A wear pattern, as shown in Fig. 4, is typical. In these cases the mating materials to the carbon, whether cast iron or ceramic, will show little or no wear and will look typically like Fig. 1.

Fig. 1. A carbon seal ring before use.

Fig. 2. A worn carbon ring.

Fig. 3. Mating ceramic ring to carbon ring of Fig. 2.

Sometimes treatments raise the causticity of the system above a pH of 9, at which point even a ceramic part is subject to attack or etching. Figure 5 is such a ceramic ring after less than a year of operation at a pH of 11.5 and 200-220 deg. This etched roughness caused the carbon ring to wear to destruction. The chalky surface is noted by the scratches.

A properly designed closed system needs little or no treatment and only the uninformed would create conditions destructive to the mechanical equipment. Where water losses become so great that the term "closed system" no longer applies, the wise water-treatment consultant will refer his client to a good consulting engineer or contractor if the client cannot locate and correct his own system problems.

When a pump has been selected, then later the system is altered in a way that reduces the head requirements, or an error was made in computing the original head requirements, the pump, by not fitting the job, may operate at such a low head that cavitation occurs. This is usually quite noticeable as noises or rattling in the pump casing.

This vibration causes premature seal failures as well as bearing failures. An identical condition occurs when the fluid being pumped flashes into vapor at the pump suction because the pressure is not adequate to maintain a "solid" fluid at the pumping temperature. Figure 6 shows a seal failure under cavitation condi-

tions. The faces actually vibrated against one another, chipping off the face shown.

When starting a system the air must be eliminated from the piping to start flow. Thereafter the flow will pick up air throughout the system and circulate it with the water flow. Most systems today are so designed that slugs of air cannot reach the pump to cause shock, nor fill the pump casing causing the pump to run dry. Air separation and collection devices used in the modern system are so located that the air (gas) is prevented from re-entering the circuits. Thus the system circulates completely air (gas) free, and the compression or expansion tank maintains its proper cushion. This procedure becomes increasingly important for good pump operation as operating temperatures approach or exceed 250 deg.

Many times standard seals are permitted to operate continuously at 250 to 270 deg. Naturally they will fail prematurely as the component parts have a life expectancy directly proportional to the temperature and the standard seal limitations usually indicate 225 deg as a top operating temperature. Some operators knowingly exceed the temperature limitations and prefer making one or two standard seal changes a year, rather than use packing gland type pumps with continued leakage and make-up water problems. Seal manufacturers can provide units for a wide variety of temperature and pressure conditions but these must be specified or requested of the pump manufacturer.

The quickest way to destroy any pump seal is to run the pump without fluid. With no fluid in the pump, the seal has no way to dissipate the developed frictional heat and is without benefit of the fluid for a lubricant. A mechanical seal is dependent on both. While, as noted before, air or vapor in the pump can cause dry operation, the most frequent failures occur because the pump is started for electrical checkout before any fluid is placed in the system. A pump allowed to run from five to ten minutes without fluid will have a damaged seal, and a premature failure is likely within the early months of operation.

The record shows that the number of closed systems outnumbers the open systems many times. Overall performance of the closed system design has proven itself for the past twenty-five years and the need for an approach to system protection has not been justified beyond that which is outlined here.

Fig. 5. Ceramic ring exhibits etched roughness due to high temperature, high pH.

Fig. 6. Seal failure under cavitation conditions.

An open system is exemplified by a system using a cooling tower. The water is exposed to the air and water losses are continuous. Any system with some portion exposed to the atmosphere or requiring continuous or large amounts of make-up fluids must also be considered in the same category. If the system cannot be made a closed system some corrosion protection in keeping with the type of system must, of course, be used.

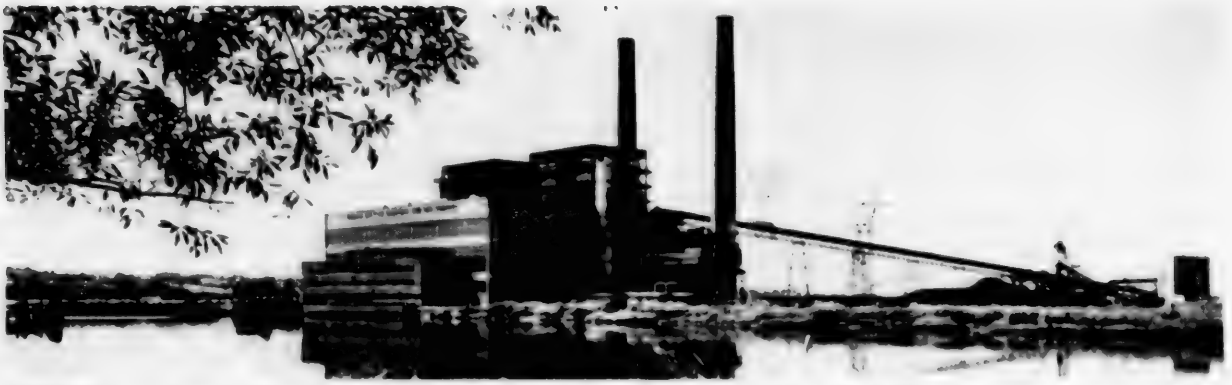
A large Eastern area has in excess of fifteen thousand open systems (exclusive of well and dewatering systems) in operation with a great percentage of these cooling or spray towers. The pumps use mechanical seals.

Mechanical seals can fail in these systems from the same causes found in closed systems and already described. Seals perform an excellent service if the precautions outlined are followed for good pump operation. Vortexing at the tower suction line inlet, and air intake to the circuits must be prevented to avert both pump and seal damage, as discussed. Quick closing valves or water hammer often will damage pumps and many times will cause seals to fail in the same manner as cavitation.

Treatment of the water in open systems must not be excessive but within prescribed limits and the water kept neutral for as long a period as possible. Cooling towers must have a continuous blow-down to the drain during operation, otherwise the debris washed from the air and concentration of solids by evaporation will accumulate to such proportions as to erode the seal parts. The amount of blow-down is determined to maintain the concentration of solids at a minimum level.

In general, nothing other than standard seals are necessary for any open system and pumps are usually selected from stock. These pumps are designed for quick seal replacement, if necessary, as well as for mechanical simplicity.

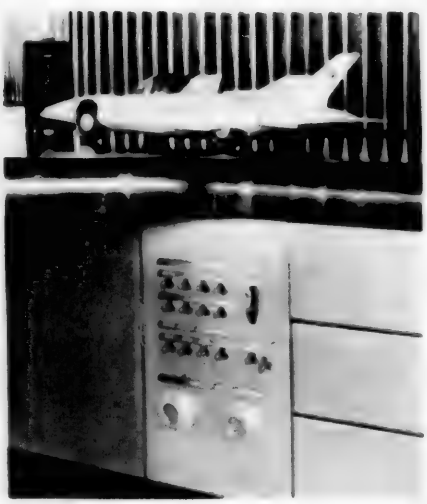
Seal failures in all systems usually occur because simple, fundamental procedures are overlooked. The hydraulic system should be considered as a whole to determine the cause of seal failures, not merely looked for and pinpointed in the pump. Centrifugal pumps, as generally stocked, are suitable for conditions found throughout the country when used properly.



ELECTRIC GENERATING STATION shown above is most recent addition to Public Service Electric and Gas Co. system. Serving northeast New Jersey with an installed capacity of 580,000 kw, the station incorporates some interesting systems. The turbine room and boiler house areas for each of two turbine-generator units are supplied with 150,000 cfm of filtered, evaporatively-cooled air in summer, and a reduced quantity of filtered, warmed air in winter. This air is exhausted by turbine room roof fans and boiler house roof and wall fans. The control room (half of which is shown at left), conference room, watch engineers' office, and relay room have year-round air conditioning, as have the cafeteria (shown below) and all offices in the service building. The service building also has two ventilating systems, one for 24-hr duty and the other for daytime, serving machine shop, storerooms and locker rooms.

Picture Paragraphs

"INVERTED COATHOOKS" are among the most unusual thermostats ever designed by Minneapolis-Honeywell during its 75 years of building temperature controls. They comprise a handful of inch-long, L-shaped tubes jutting out from the walls of the styling administration offices at General Motors' new technical center near Detroit. Because of restrictions, the firm's round thermostat could not be used. So these "thermostats of the future" were designed by Honeywell engineers to blend with the aluminum-and-cherrywood decor of the styling offices. To provide faster and more sensitive control, engineers put an electronic sensing element inside the 3/16-inch dia tube. The element reacts almost immediately to even a minuscule change in room temperature. Control knobs on a deskside console (shown at right) are used to set whatever temperature is desired. Other switches on console electrically adjust window curtains, lights and dimmers.



Methods for Control of Reciprocating Water Chillers

Part 2

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Here is the conclusion of a two-part study which began in the November issue of Air Conditioning, Heating and Ventilating. Part 2 analyzes the various methods of controlling chilled water temperature and includes, for each method, a control diagram, temperature vs. system load chart, and recommended applications. It might be well to have Part 1 at hand since several of its illustrations are referred to in this final installment.

Cycling the Compressor

Figure 9 is a typical control diagram for a water chiller control system which cycles the compressor to maintain water temperature. This system may be equipped with one or two compressors (or possibly more) which do not have any capacity control. A single or multi-stage thermostat is then used to open the solenoid valves on the refrigerant circuit, and to actuate the control relay.

At any condition except at full load, the compressor will cycle. As the load gets lighter, the running time will be less; however, the cycling will still exist.

In many water chilling systems of this type, the frequent cycling at anything but full load has been found objectionable. Many systems have been developed to slow this cycling down. The most popular system uses a back pressure regulator or a hot-gas bypass.

The back pressure regulator automatically throttles the suction gas to maintain a constant refrigerant evaporator temperature. However, the use of a back pressure regulator has definite disadvantages.

(1) With a back pressure regulator in the system, the compressor will still cycle. However, it will probably cycle less frequently, because it has to pull the pressure down much further than it would on a normal refrigeration system.

(2) At light loads, the refrigerant velocity in the evaporator is extremely low, and will not carry the oil along through the system properly, thus trapping the oil in the evaporator and causing tripouts of the oil pressure control.

(3) Operating costs are increased because the compressor is operating at full load continuously, and because of frequent compressor starting and accompanying high surges of electricity.

(4) The compression ratios are increased, causing increased compressor wear.

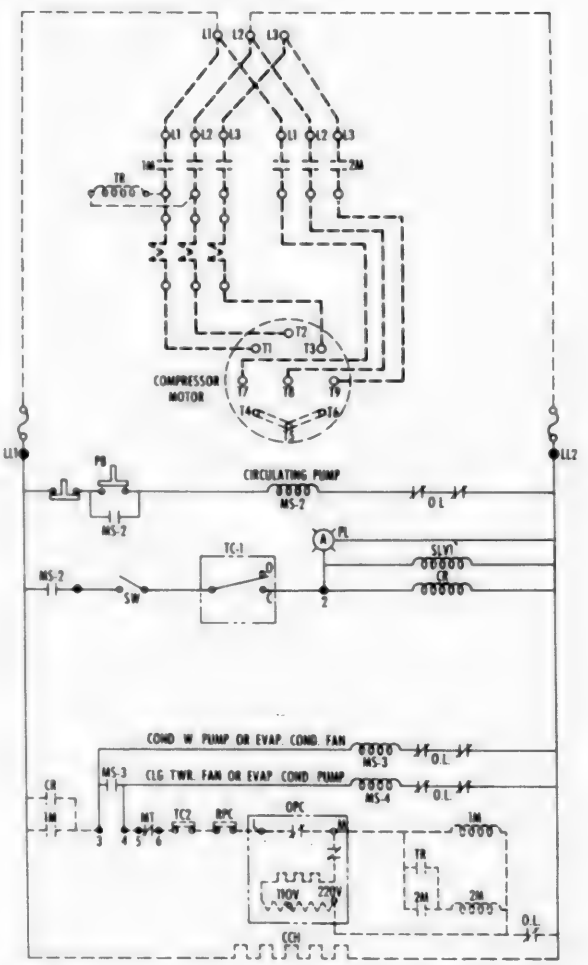


Fig. 9. Typical control diagram for a water chiller system which cycles the compressor to maintain water temperature. This diagram also applies to temperature control based on suction pressure drop.

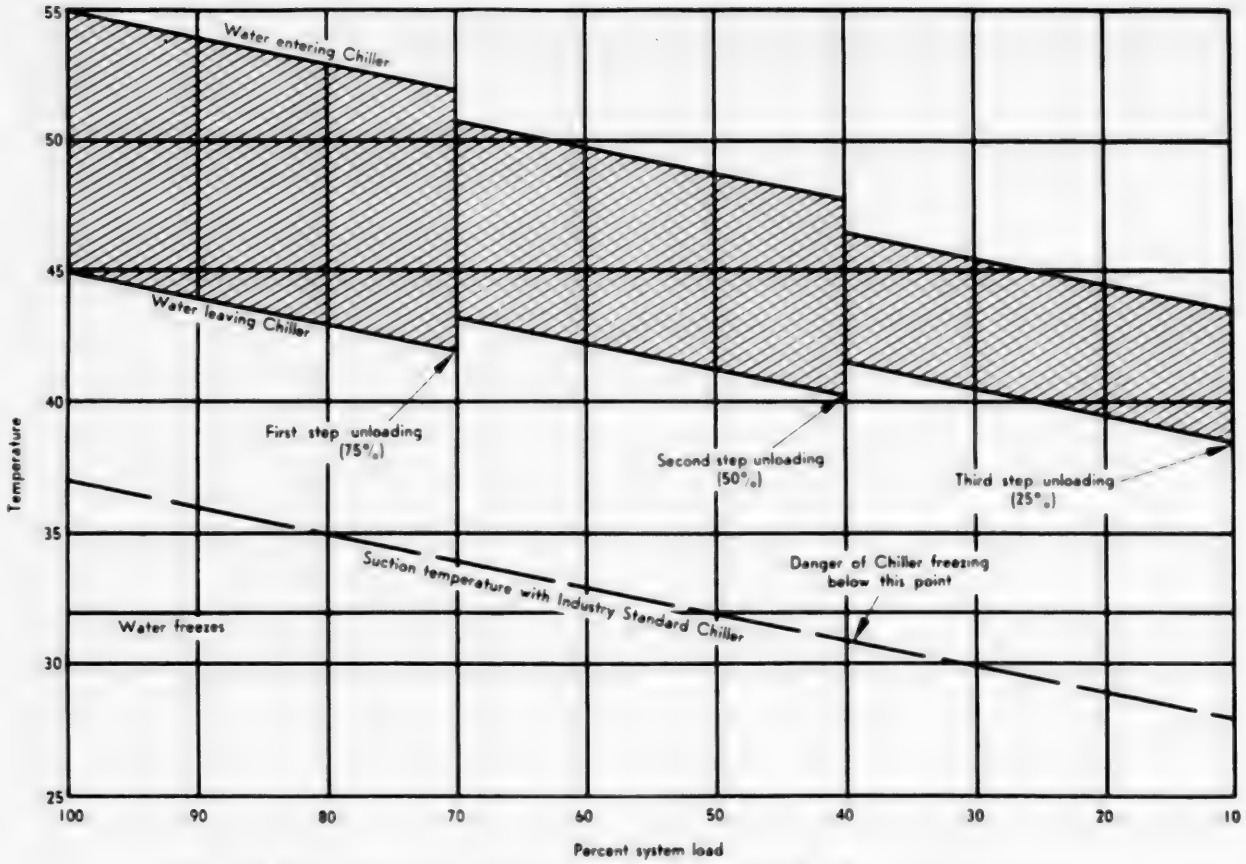


Fig. 10. Temperature versus system load in a system which utilizes suction pressure unloading to maintain water temperature.

(5) The back pressure regulator is large, heavy, and adds considerably to the complexity of the piping system and to the complications of servicing.

A hot-gas bypass system effectively puts a false load on the evaporator by adding hot gas to the liquid refrigerant entering the evaporator. This system can give very accurate temperature control. If hot gas is added to the liquid before the evaporator, the flow of refrigerant through the chiller is not reduced. The oil trapping problem encountered with the back pressure regulator is therefore eliminated. However, there are two disadvantages to the hot-gas bypass.

(1) Operating costs are high because the compressor operates at full load continuously, even when there is no load on the system.
(2) Refrigerant piping is complicated and the additional controls add to initial cost and servicing problems.

Temperature Control Based on Suction Pressure Drop

The sequence of operation of a control system based on suction pressure drop is the same as that of the control system which simply cycles the compressor (Fig. 9) while in operation. However, the compressor will unload in this system, as illustrated by Fig. 1 and 2, thus providing a longer period of operation between cycles.

Figure 10 is a graph showing temperature versus system load. For this particular example, the situation of cooling water at full load design from 55 to 45 deg is used. The normal suction temperature at these conditions for the compressor is about 36 deg. The typical compressor used on a suction pressure unloading system with refrigerant R-22 requires a pressure drop equivalent to 12 deg suction temperature drop to unload from full load to its minimum step. You will note that in order to unload to 25% of full load, the suction temperature would have to drop to 24 deg. Because water freezes at about 32 deg, going to this low a suction temperature is not possible. In order to illustrate how this problem is best solved, let's go through the operation of a typical system as the load drops off.

Referring to Fig. 10, as the system load starts falling. the water temperature returning to the chiller starts to drop. The compressor is still operating at full load, and will continue to operate at full load until the water temperature, returning from the air handling units, drops to 51 deg. At this point, the unit has capacity to cool water over a 10-deg range, from 51 to 41 deg. The suction temperature has dropped from 37 to 32 deg, and at this point the drop in suction pressure will cause the compressor to unload one step. With a four-cylinder compressor, this means the unit now has capacity to cool water 7.5 deg. At full load, it was cooling around a mean of 50 deg. It will now cool 7.5 deg, around a mean of 46 deg, 4 deg lower than design conditions.

As the system load drops further, the return water temperature will drop from about 50 down to 47.5 deg. At 47.5 deg, thermostat *TC1* senses the light system load, and will cease calling for cooling. This means that the compressor will cycle at a minimum unloading stage of 75%, and makes the system slightly better than the system without any cylinder unloading in the compressor.

If the controls are properly adjusted, the suction temperature will not go below 31 deg. On most units where suction pressure unloading is used, the *TC2* freeze-up thermostat (Fig. 9) is replaced by a pressure switch, which is set at the equivalent of about 30 deg saturated suction temperature. You will remember that at 75% of compressor full load, the suction temperature was 31 deg. As the load drops off on the system, the water temperature drops, and the suction temperature and pressure will drop. When it hits the pressure equivalent of 30 deg, the compressor will start cycling on the pressure switch in the system, and again, will never unload below 75%, even if *TC1* is set to open lower than 47.5 deg.

In this system, although the compressor is equipped to unload down to a minimum capacity step of about 25%, the system cannot utilize this unloading because of the fact that water freezes.

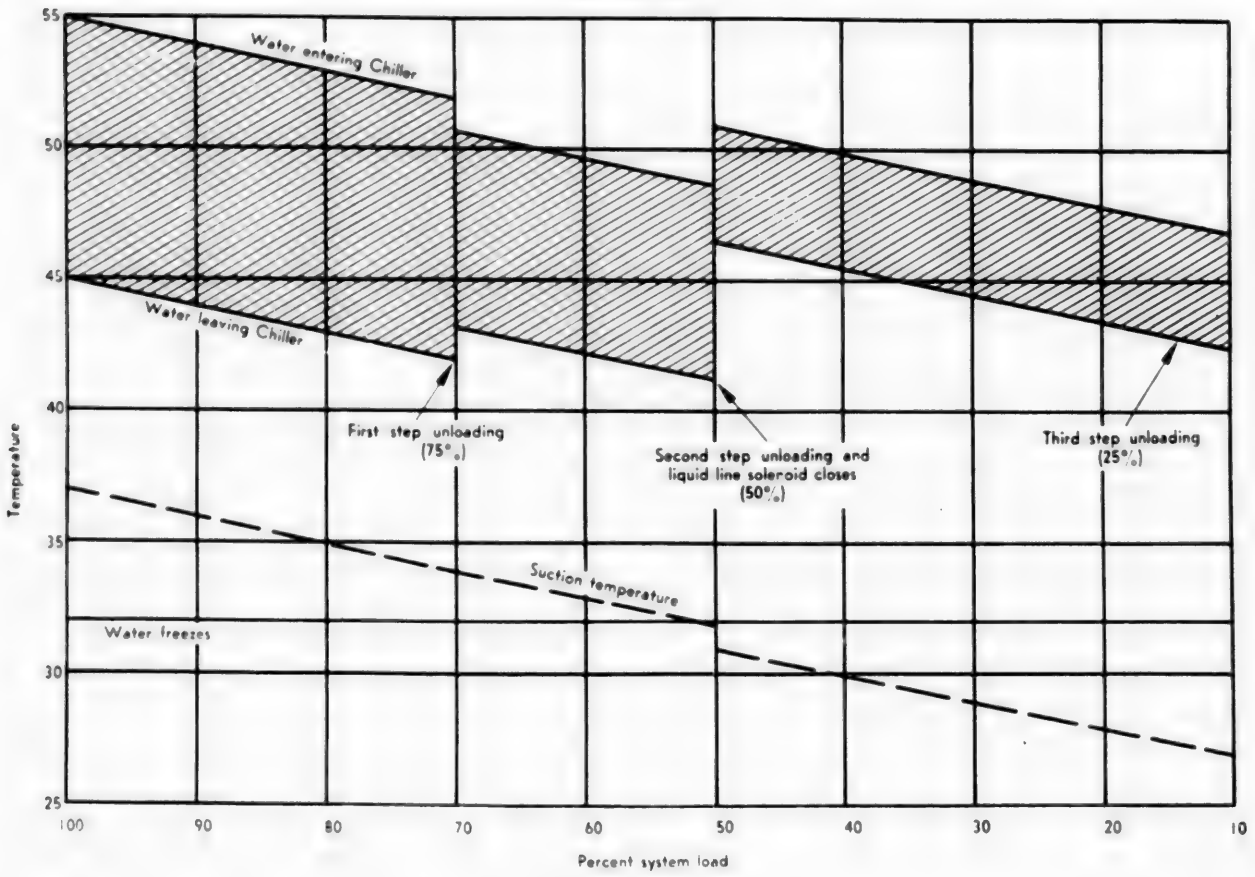
You will also note the wide variation in leaving and entering water temperatures with this particular type of system. This system should be used on units where full load operation is the rule, such as telephone dial exchanges, computer rooms, and process jobs where the system load does not vary, summer or winter.

Water Temperature Control by Controlling Evaporator

Figure 12 is a typical line diagram for the control system using evaporator water temperature control. The sequence of operation is essentially the same as for the previous types of systems. However, the *TC1* temperature controller, instead of just starting and stopping the compressor, also controls a two-circuit evaporator.

Figure 11 is a plot of temperature versus system load. As the system load starts to drop off, the water temperature again is reduced. When the water temperature gets down to about 52.5 deg, the suction pressure actuator is set to unload the machine one step. This gives the unit the capacity to cool the water down 7.5 deg around a mean of about 47.5 deg. As the load drops off further, the thermostat *TC1* will sense the return water temperature arriving at the 50-deg point, and will shut off half of the evaporator through liquid line solenoid valve *SLV2*. This cuts down the effective heat transfer surface and increases the differential between refrigerant temperature and mean water temperature. Thus, the water temperature goes up, cutting down on the probability of freezing. As the suction temperature goes down because of the reduction in the heat transfer surface, the compressor will

Fig. 11. Temperature versus system load in a system using evaporator water temperature control.



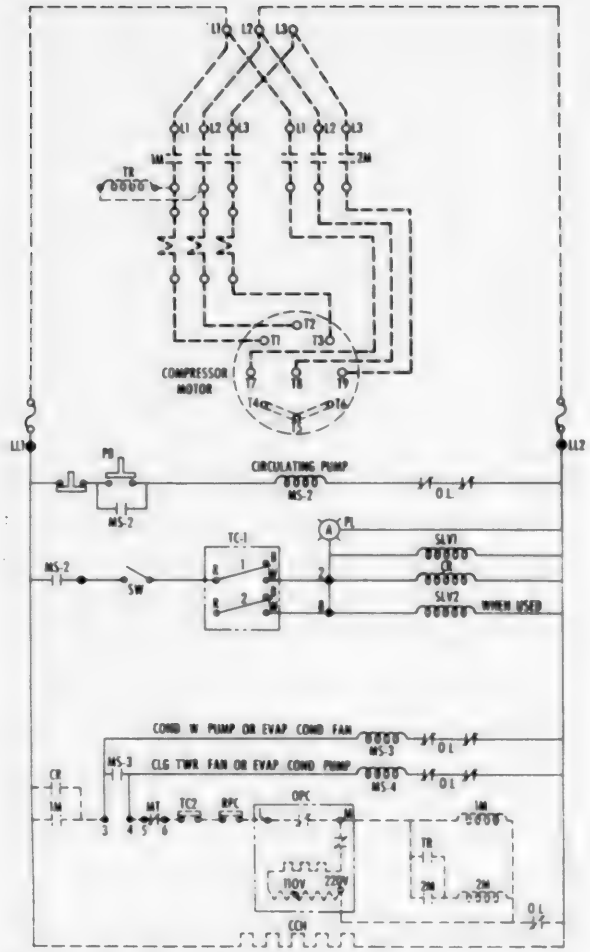


Fig. 12. Line diagram for a system using evaporator water temperature control.

unload to its 50% stage, and then would have capacity to cool water 5 deg. When the return water temperature gets down to 47.5 deg, the thermostat *TC1* will close liquid line solenoid valve *SLV1* and pump the compressor down.

This control system gives a wider range of operation without cycling. However, it still cannot use the full capacity control built into the compressor. When below about 50% of system load, the compressor will cycle on and off the line to maintain the water temperature in the system.

This system should not be used where close water temperature control is required, or where frequent cycling at lighter loads would be objectionable.

Full Modulating Water Temperature Control

Figure 13 is a line diagram for an electric modulating temperature control system. For electric control, a four-switch *TC1* is used. This controls three-way solenoid valves which control the compressor as shown in Fig. 5 and 6. In a pneumatically-controlled modulating system, the standard compressor with suction pressure actuator is used with the pneumatic connection to the bellows from a reverse acting pneumatic thermostat, as shown in Fig. 3.

Figure 14 is the temperature versus system load graph for either the pneumatic or electric type system. In this system, the thermostat does all the work.

The electric system is easy to follow through the complete unloading cycle. As the load drops off, the thermostat senses the return water temperature. When the return water temperature gets down to 52.5 deg, the compressor still has capacity to cool water in the 10-deg range and cools it from 52.5 down to 42.5 deg. At this point, the suction temperature has dropped from 37 to 34.5 deg. At 52.5 deg, the four-switch thermostat opens switch 4, unloading the compressor to 75% of its full load capacity through *ULV3*. The compressor now has the capacity to cool water 7.5 deg, and is not dependent upon suction presure. It will, therefore, cool the water from 52.5 to 45 deg. When the compressor is unloaded to 75%, the suction temperature will go from 34.5 to 37.5 deg. As the system load drops off further, the return water temperature reaches 50 deg. At this point, the unit has capacity to cool water from 50 to 42.5 deg, and the suction temperature is now at 35 deg. The thermostat, sensing the 50-deg water, will now open switch *3*. This unloads the compressor to 50% *(ULV2)*, cuts out half the evaporator

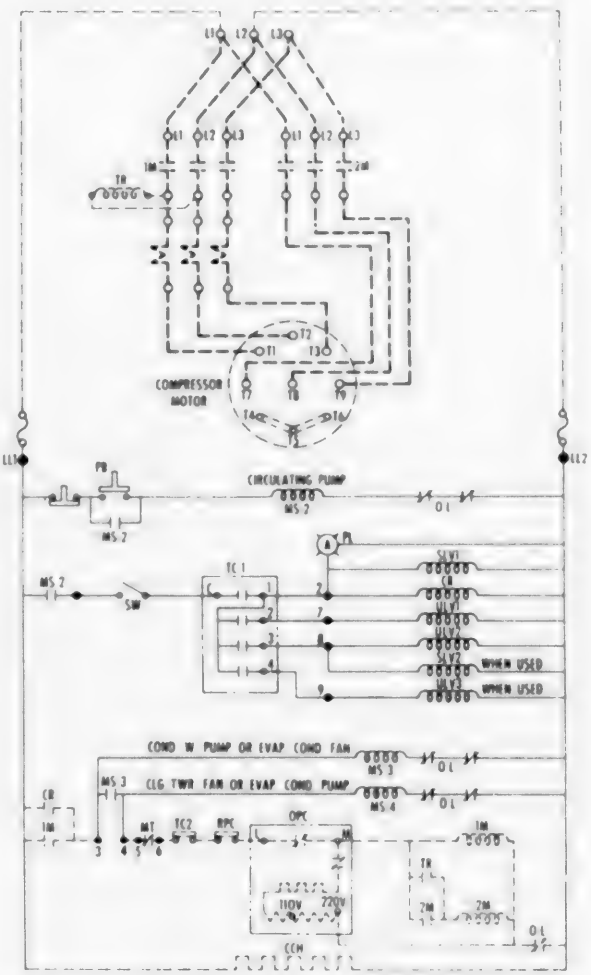


Fig. 13. Line diagram for an electric modulating temperature control system.

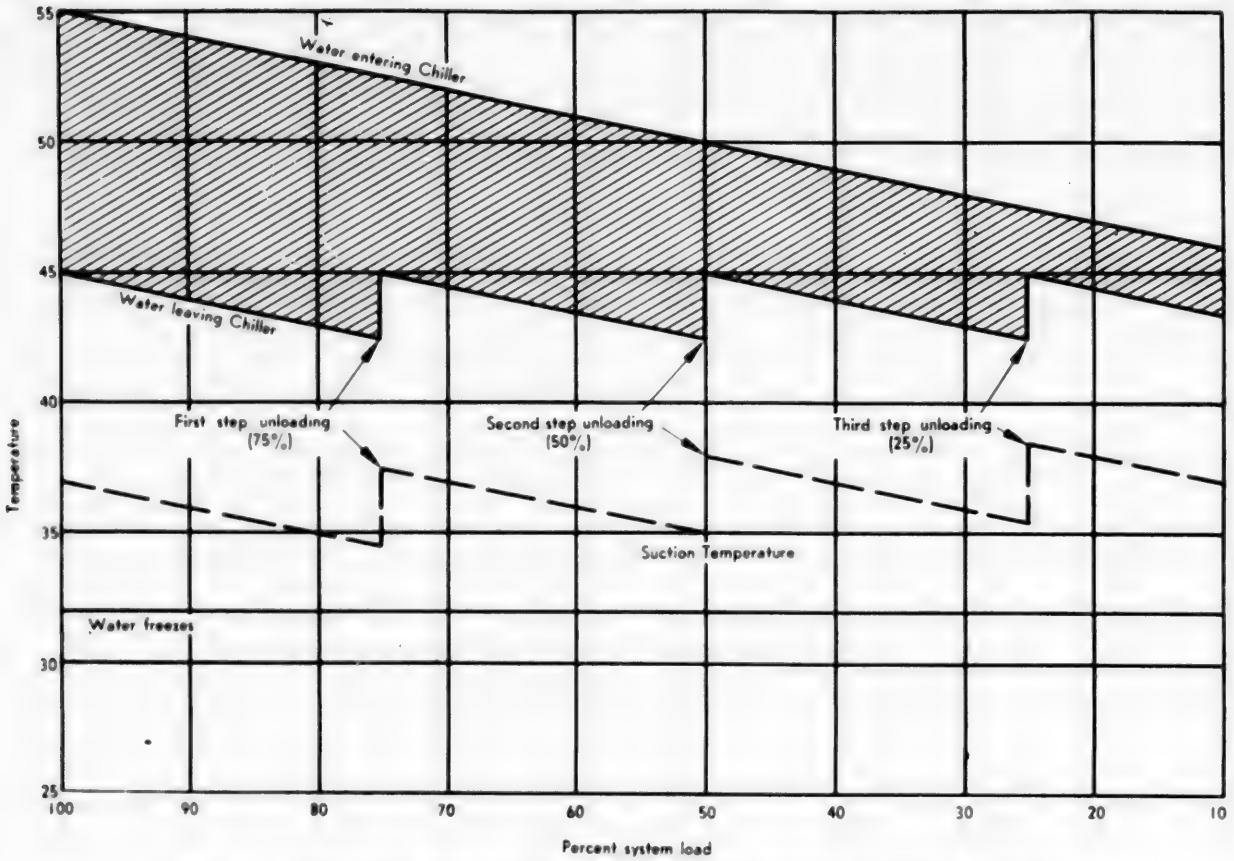


Fig. 14. Temperature versus system load for either the electric or pneumatic type of modulating system.

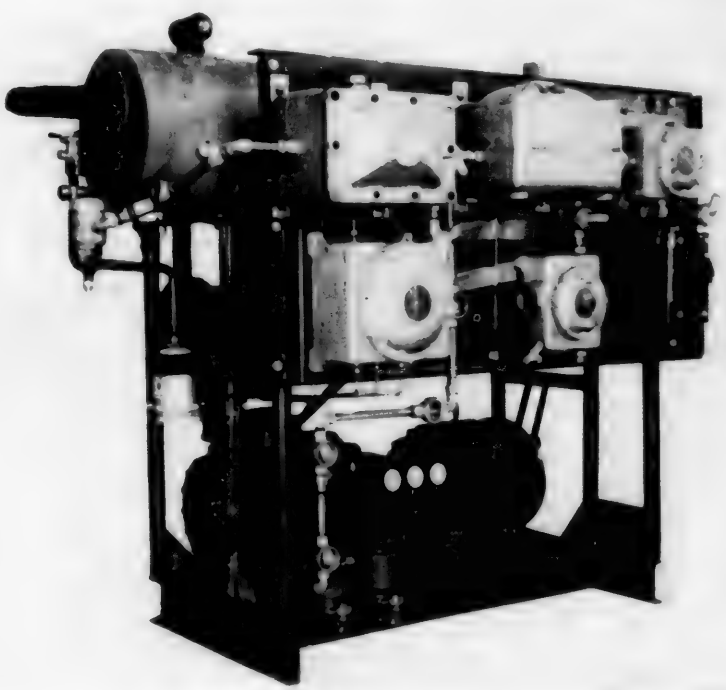


Fig. 15. A packaged water chiller equipped with a typical Class I, Group D (for hazardous locations) electric modulating control panel for application in a gunpowder factory.

(SLV2), (maintaining oil velocities high enough to properly return oil to the compressor through the other half), and also keeps the expansion valve operating above 50% of rated capacity so that pilot-operated valves are not required. The unit now will have capacity to cool water 5 deg, from 50 to 45 deg. The suction temperature will jump to 38 deg.

As the system load drops further, the return water temperature will get down to 47.5 deg, cooling water to 42.5 deg. At this point, the suction temperature is 35.5 deg, and switch *2* of the thermostat will open, unloading the compressor to 25% *(ULV1)* of its full load. The unit then has capacity to cool water 2.5 deg, from 47.5 to 45 deg; the suction temperature has gone from 35.5 to 38.5 deg.

As the system load drops off further, the return water temperature will get down to 45 deg, the cooling water to 42.5 deg. At this point, switch *1* will open, the pilot light *(PL)* will go out, the second liquid line solenoid valve will close *(SLV1)*, and the unit will pump down and shut off.

As you can see, this system gives excellent leaving water temperature control. The suction temperature, instead of going down at light loads and endangering a freeze-up in the chiller, actually rises. And, the compressor will not cycle until the system load is below 25% of system load design. Below 25% of system load, the ventilating air would usually take care of any cooling that is required in the system, thereby eliminating any cycling problems.

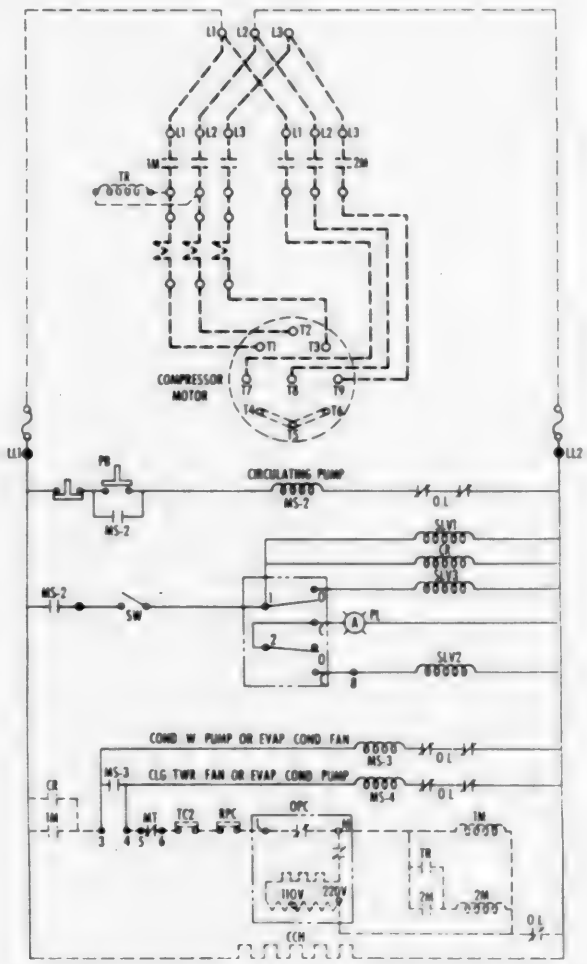


Fig. 16. Typical control diagram for a system where it is essential that the water chiller be operated continually.

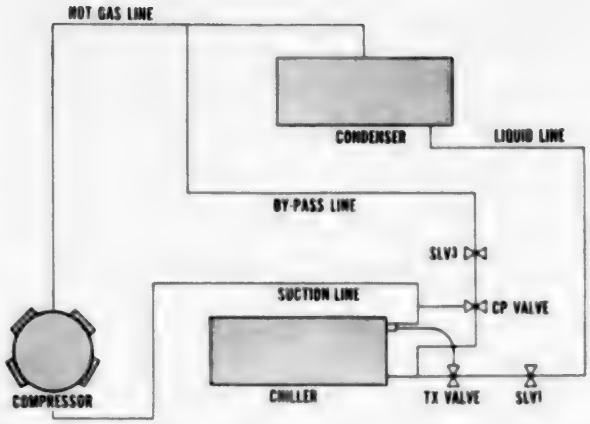


Fig. 17. Schematic piping arrangement for a continually operating system.

Basically, the pneumatic system operates in the same fashion and gives exactly the same control.

Critical Areas of Operation

In some instances, it is extremely important that there be no line voltage fluctuation in the area where the unit is employed. These installations would include large electronic computer installations, radar systems, X-ray equipment, and radio transmitters and receivers. A voltage fluctuation would necessitate recalibration of the electronic equipment.

On systems of this type, it is absolutely essential that the machine be kept in operation 100% of the time, and only started and stopped at the discretion of the operator. For this type of control the hot-gas bypass, described earlier, is used. A constant pressure valve is installed in the hot gas line to pass a maximum of 12.5% of full load hot gas flow into the evaporator, thus providing no water cooling at minimum load. This method does, however, provide the compressor with enough gas to properly cool the cylinders and does not start and stop the compressor motor. Figure 16 is a typical control system, and Fig. 17 is a typical schematic piping arrangement for this type of setup. The advantages of the full modulating control system are retained, plus the no-cycling feature, to give excellent and economical water temperature control.

Summary

As can be seen from various charts used to illustrate this discussion, it will pay the owner to have *good* controls. The spending of another $100, $150 or $200 on a $10,000 piece of equipment is a very minor item compared with the trouble that can be encountered with frequent cycling and poor temperature control in a system. It is hoped that the information provided will give the specifiers of this equipment more of an insight on the various methods used for controlling reciprocating water chillers.

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HYDRONIC HEATING DESIGN FOR COMMERCIAL AND INDUSTRIAL BUILDINGS

To engineers active in hydronic heating, as well as to less experienced practitioners, this panorama of low-pressure hot water heating is directed. It is the author's intention to present design techniques that provide top performance from this type of heating in commercial and industrial work.

AIR CONDITIONING, HEATING AND VENTILATING'S REFERENCE SECTION

LET US START analyzing this subject with a series of basic questions and their answers.

Question: Just what types of buildings are classed as commercial, which are industrial, and why should they be regarded as different?

Answer: In the commercial classification we include retail stores, department stores, offices and banks. The industrial designation applies to factories, mechanical shops of various kinds, assembly plants and warehouses.

Commercial buildings and the industrials differ in at least 3 characteristics, all of which importantly affect the application of heat. The first difference is in the level of heat required: the industrial generally is substantially lower. Second, industrials commonly have large open spaces to heat; the commercials have more and smaller spaces. And third, high ceilings, cold spots, hot spots, and spot heating, all likely to be complicated by drafts, are familiar problems in an industrial project. These are relatively rare in commercial structures.

Question: Are there any particularly good reasons for preferring low pressure hot water to warm air or steam in these classes of building?

Answer: In most instances, yes. One good reason is that a 2-inch hot water pipe, run between a boiler and a fan coil 100 ft apart, occupies much less space than would an air duct, or even a steam pipe, of equivalent capacity. We know that space is highly critical in commercial buildings. For example in a retail shop, display counters and cases are the owner's first consideration. Such displays are greedy for space and after they've been satisfied, the heating appurtenances must be fitted into what is left over, seldom much.

As another example, factories and heavy equipment shops usually are cluttered with machinery, including such awkward objects as drill presses, jib cranes, even bridge cranes, and snaking a continuous pipe or duct system through such mazes is a problem not simplified by bulky dimensions in the heat carrier. The hot water system therefore has a comparative advantage in such environments.

Another good reason is the flexibility of pumped hot water arrangements. Commercial and industrial structures frequently incorporate several distinct climates in their various areas, and if these various demands can be satisfied by a single heat source, the economy of the job generally is promoted. Thus hot water from a central boiler can be sent to rooms fitted with convectors; beyond the partitions of these rooms, unit heaters may be set up, or a radiant panel floor or ceiling provided; still farther along the hot water main, a fan coil may be warming up air for local duct distribution. Each area can be heated with the apparatus that fits it best, the hot water being the basic servant of all.

Figure 1 illustrates this flexibility.

We should note that steam which otherwise would be wasted is frequently found doing heating chores

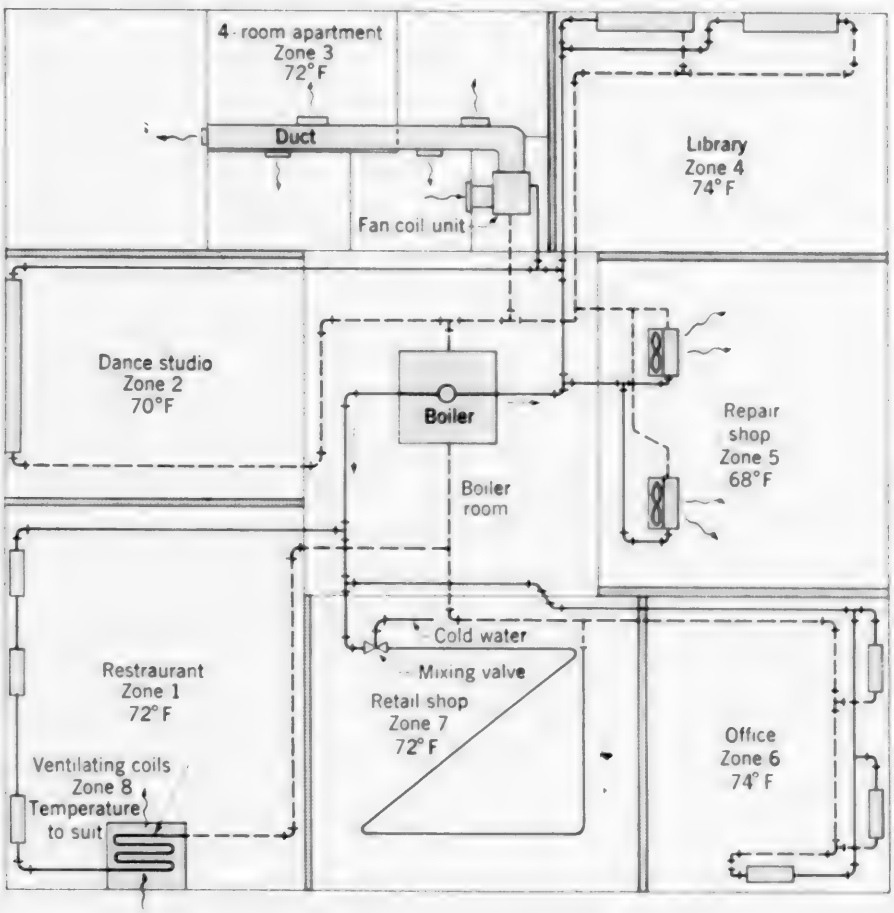


Fig. 1. Hydronic heating has the flexibility to meet the various demands of distinct climates within commercial and industrial structures:
Zone 1—Convectors, 1-pipe series loop
Zone 2—Baseboard, single pipe
Zone 3—Fan-coil duct system
Zone 4—Fan-coil room units
Zone 5—Unit heaters
Zone 6—Convectors, 2-pipe direct return
Zone 7—Panel ceiling
Zone 8—Fan-coil, for heating restaurant fresh air

Hot water delivery takes four forms:

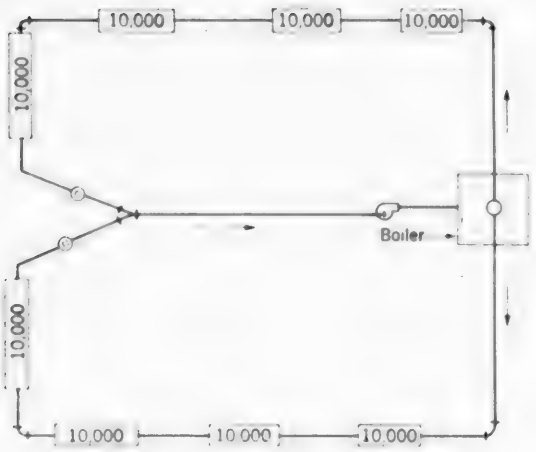


Fig. 2. Series loop arrangement

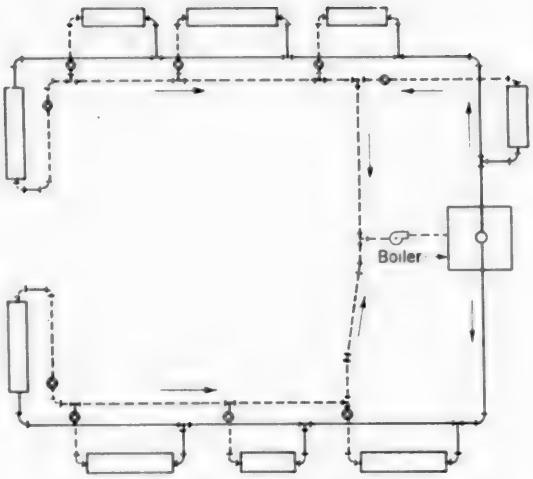


Fig. 4. Two-pipe direct return arrangement

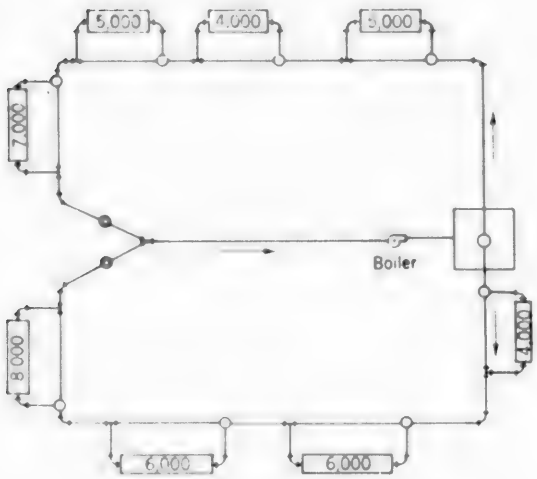


Fig. 3. One-pipe diversion loop

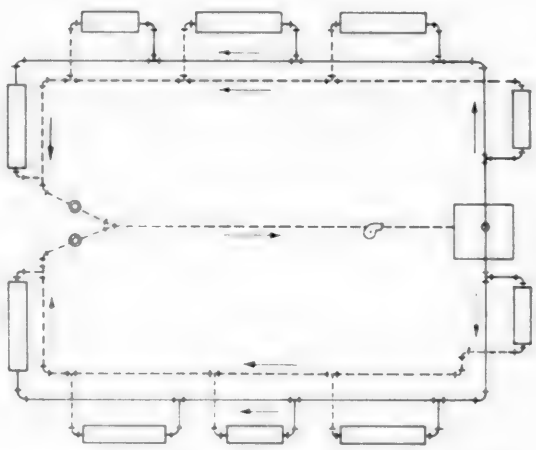


Fig. 5. Two-pipe reversed return arrangement

for an industrial activity. Economic comparisons are likely to favor the waste steam over a hot water system for these installations. However one point that must be considered is the effect of the source or prior use of the steam on the steam itself. To explain, low pressure steam taken from an engine exhaust header is almost certain to bear traces of oil; consequently if adequate steam purification is not accomplished before the steam enters the heating system, a gradual fouling of the piping, traps and other components of the system is rather certain to follow.

Comparisons always must be thorough in order to reach a dependable conclusion.

Question: Doesn't a hot water installation conflict with all-year air conditioning programs?

Answer: The question is really not one of conflict but, rather, of incorporation. Summer cooling is readily incorporated in a hot water installation by providing a water chiller. It's just as easy to pump cold water in summer as it is to pump hot water in winter. This arrangement is the basis of some notably efficient all-year designs, with fan-coil cabinets strategically located.

However, chilled water is of no practical value when circulated through convectors, baseboards, or radiant panels. In the convectors and baseboard, heat exchange is insignificant unless the ambient air is forced to circulate over the cold surfaces. For the radiant panels, surface condensation is a hazard in most areas of the country, although in some parts of the Southwest where humidities vary between 15% and 25%, cold panels probably have a better chance of doing a helpful job.

In general, we can expect to provide some form of auxiliary cooling whenever fan coil apparatus is not a part of the area heating scheme.

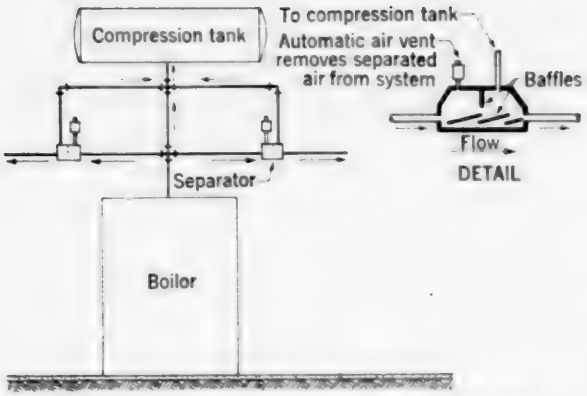


Fig. 6. In most installations the piping arrangements allow one air separator to suffice. Two are shown here to suggest a technique for handling two circuits with flow in opposite directions.

Question: If low pressure hot water is good, wouldn't high pressure water be better?

Answer: No, for reasons of cost. Once we go beyond the hydraulic limit of 30 psig on low pressure classifications, boiler prices go up and we might have trouble in obtaining convectors and baseboards for the high pressure service.

For another consideration, in some states the law demands a full time licensed engineer to operate equipment at pressures over the legal low. At today's prices, an engineer attendant is an expensive employee, and if he must be duplicated with a night man, the operating cost of the high pressure system looks mighty unattractive.

In short, economy tells us to stay with the low pressure system.

Hot Water Delivery Takes 4 Forms

Whether the final heat emitter is a convector, radiant panel, fan-coil unit or whatever, the hot water system that serves it is described by one of the following designations:

(a) One-pipe series, in which the water flows through each of the heat emitting units in turn before returning to the boiler.

(b) One pipe diversion system, in which the water is diverted from the main to the emitting unit, and then returns to the main for eventual reheating in the boiler.

(c) Two-pipe direct return, an arrangement of the piping that causes each heat emitter to discharge the cooled water back to the boiler by the shortest possible route.

ings of small or moderate size. This is because each

(d) Two-pipe reversed return, a design that endeavors to place all the heat emitters on circuits of equal length, so that the pipe friction to and from each unit is approximately the same.

Each of these four arrangements is illustrated by the single line diagrams of Figures 2, 3, 4 and 5.

Systems (a) and (b) are largely restricted to build-heat emitting unit is served progressively cooler water as the distance from the boiler increases, and eventu-

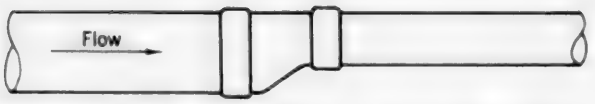


Fig. 7. To avoid air pockets, use eccentric reducers wherever the horizontal piping changes size.

ally the temperature becomes too low for satisfactory heating.

To use system (c) for balanced heating, we must control the water that flows through each heating unit circuit, otherwise short-circuiting takes over and some areas will be overheated, others underheated. The use of balancing cocks is recommended, a cock being placed on the return from each unit and set to permit the proper flow for that unit and no more.

System (d), the reversed return, achieves balance by replacing the cocks of a direct return arrangement with a return main that is calculated to make all of the heat emitter circuits of equal length, and consequently of equal friction. This scheme has the advantage of eliminating the individual balance cocks, and the disadvantage of expanding the amount of pipe which must be used on a job.

For the large installations, as a general rule, we'll choose either (c) or (d); however in many cases where multiple zoning is involved, individual zones in the form of (a) or (b) may be found to best suit the requirements of a particular zone. In other words, we have 4 forms of hot water circulation within our control, to be used as circumstances indicate. This is another illustration of the flexibility characteristic of hot water heating.

Design Guides from Successful Practice

Experience obtained from countless hot water installations of all kinds has demonstrated that various actions taken, or various actions not taken, can be the difference between a trouble-free job and one of nagging difficulties. Some of these "do it" and "don't do it" recommendations will be tabulated as they apply to, first, all forms of systems, and after that to the specialized arrangements of one-pipe, two-pipe, and so on.

Many of these recommendations apply to other installations as well as to the commercial and industrial

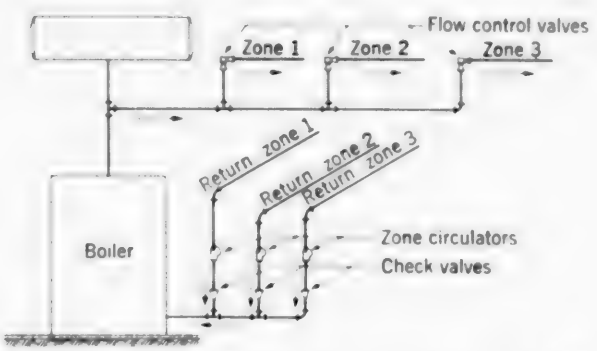
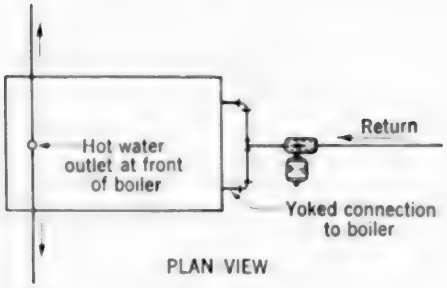
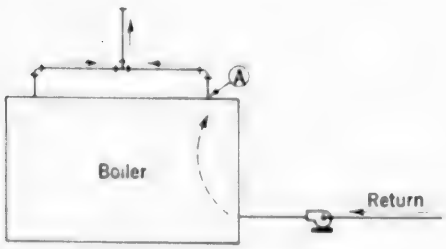


Fig. 8. Schematic diagram shows proper use of both check valves and flow control valves.

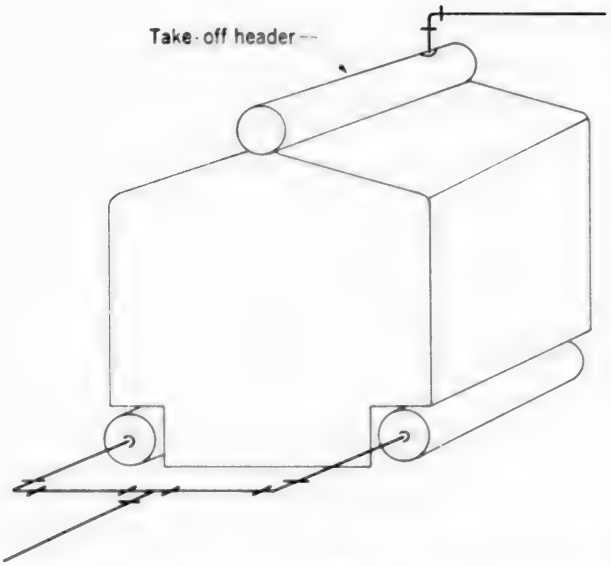
Fig. 9. Satisfactory ways for connecting a return to a boiler:



This is good but outlet must be at front of boiler. Do not move back.



Dotted lines show possible short circuit to rear boiler outlet. Install valve and throttle at point A to balance resistance with front outlet.



Return yoke is good. Hot water must be taken from front as shown.

categories; they appear here because of their universal significance, and must be included.

I—Design Recommendations for All Layouts

1. Limit the flow velocity through the piping to a maximum of 4 feet per second.

Reason: Greater velocity steps up friction losses in the piping, and also can create objectionable noise.

2. Pump *out* of the boiler for large jobs, for those with high pumping heads, and when the radiation is level with, or below, the water line of the boiler.

Reasons: The technique of hydronic pumping is inescapably part and parcel with the position of the compression tank, and is sufficiently complex to justify a detailed discussion. This will appear as a separate subject, immediately following the present listing of design guides for all layouts. Meanwhile, when the radiation is below the boiler or of similar elevation, by pumping out of the boiler we shift the boiler to the suction side of the pump, thereby increasing the pressure on the system, a condition that helps a great deal in venting.

Another benefit is less likelihood of pump cavitation, since the air separates largely in the boiler rather than later in the pump.

For high head pumping, and for buildings more than three stories high, pumping out of the boiler becomes practically obligatory to avoid spilling of the relief valves on the boiler, and to escape some occurrence of boiling at the high points. Why this is so is made clear in the discussion of pumping.

3. Be critical of air entry, pocketing and elimination. Venting is essential at the high points of the circuit, and is recommended additionally at the boiler outlet. An air separator, Fig. 6, is effective since the separation and removal of the air takes place in an area of high water temperature, and where separation probably is easiest.

To avoid air pockets, use eccentric reducers wherever the horizontal piping changes size. Figure 7 illustrates this point.

4. Use balance cocks to balance water flow through circuits of unequal loading whenever these circuits merge into a common main.

Reason: Water naturally takes the circuit of least resistance; consequently unless the flow is controlled, somebody will be overheated and somebody will be underheated.

5. Do not impose a cold fill pressure on a low pressure boiler in excess of 19 pounds psig.

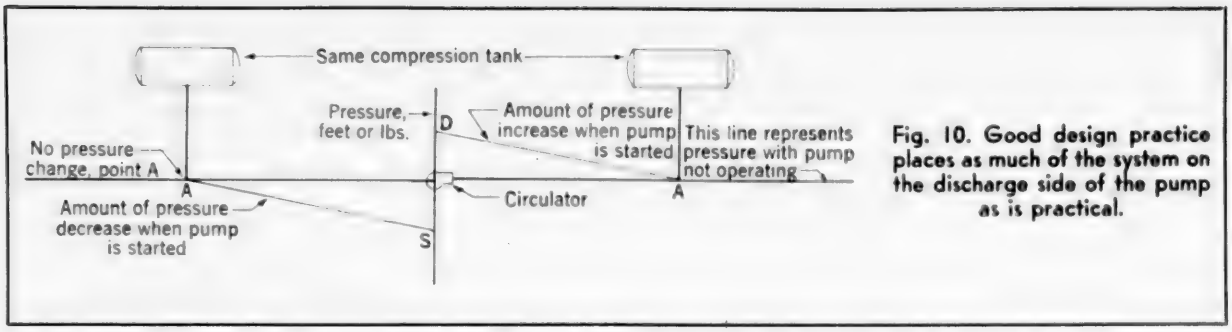


Fig. 10. Good design practice places as much of the system on the discharge side of the pump as is practical.

Reason: When the water is heated, the heating is accompanied by a rise in pressure, and this rise may be enough to open the pressure relief valve. For example, by heating a cold boiler from, say, 50 to 200 deg F, the pressure rise will approximate 10 psi. Add this to a fill pressure greater than 19 psig and we crowd the relief valve setting of the conventional 30 psig. Then a little unfavorable variation of pumping conditions will open the valve.

A commonly used cold fill pressure is 12 psig, but this may be inadequate for high buildings. When pressures under operating conditions are greater than 30 psig, we slip out of the low pressure class, and must provide a boiler and appurtenances suitable for the more severe conditions.

6. If the layout calls for two or more pumps to discharge into a common header, a check valve or flow control valve is essential on each discharge.

Reason: To prevent backflow into a non-operating circuit. Similar equipment is required to prevent unauthorized circulation in a group of circuits fed from a common supply but having individual returns. Figure 8 shows both situations.

7. Satisfactory ways for connecting a return to the boiler are illustrated in Fig. 9.

In general, the philosophy of boiler connections, both inlet and outlet, is to equalize the paths of flow through the boiler. Complaints of inadequate capacity sometimes originate in an incorrect arrangement of boiler connections, the trouble being that the water finds a short route to the outlet nozzle and thus leaves the boiler at less than the intended temperature. This situation is aggravated if the temperature control is mounted in a hot spot which is off the path of water circulation and consequently shuts down the firing equipment prematurely. When the boiler and system appear to be of adequate capacity but the building occupants are dissatisfied, a critical examination of the water flow pattern is indicated.

Locating the Circulator

Before the hydronic designer decides on the pump location he must understand, and evaluate, several items of fundamental importance. Here they are:

1. Wherever the compression tank connects into the system, this is the one point on the whole circuit that is not affected, pressurewise, by the starting and stopping of the circulator. Reason: once the system has been filled, pressure in the compression tank cannot be increased hydraulically unless more water is forced into the tank. Since there isn't any more water available (the fill valve being closed), all the pump can do is to move the water in the circuit; the tank pressure remains as is.

2. By starting the circulator, the system pressure between the *suction* of the circulator and the compression tank connection is *reduced*. Conversely, the system presure between the *discharge* of the circulator and the connection point of the compression tank is *increased*. Figure 10 shows graphically this relationship.

3. Counting from the point of tank connection, the *decrease* in pressure is progressive to a maximum reduction at the entrance to the pump, and this maximum is equal to the friction loss between the tank and the pump. Starting again at the tank connection, the *increase* of pressure likewise is progressive to a maximum at the pump discharge, the total increase being equal to the friction loss between the tank and the pump discharge. Added together, the decrease and increase represent the total pumping head of the system.

4. At the high point of the system, the cold fill pressure should provide a positive head of about 4 ft, at least, to make sure of positive air venting. Adding a few more feet also is desirable as a check against possible boiling. And, finally, if the circulator is pumping *into* the boiler, we must increase the high point cold pressure by an amount equal to the friction loss between the tank connection and the high point. The reason for this is that starting the pump pulls down the system pressure on the suction side as we have already observed, and the amount of pull down at the high point needed to cancel out the friction loss just might be enough to neutralize the venting pressure up there, and possibly go so far as to cause boiling.

Effects of Pump Location on System Performance

When all or most of the system friction loss exists between the compression tank connection and the suction side of the pump, all or most of the system is subjected to a pressure pull down when the pump goes into operation. This condition is observed most commonly on small residential installations, where it is general practice to so locate the circulator that it pumps into the boiler, the compression tank being directly above the boiler. Ordinarily this arrangement gives no trouble on small jobs because the effect of the pump is not very great, with perhaps 4 or 5 ft of pumping head being ample.

For large systems, or high head systems, or those in which the radiation is level with or below the boiler, pumping *into* the boiler may precipitate these hazards:

1. Boiling of the hot water at high points where the pull-down is critical.

2. Poor venting of the air, followed eventually by air pocket formations that depreciate the heating and possibly become air and vapor slugs that cause cavitation, noise and pump vibration.

3. Action by the pressure relief valves, since by pumping into the boiler, boiler pressure is increased by the amount of friction between the pump discharge and the tank connection.

In view of these hazards, pumping *out* of the boiler is recommended for all such installations, and additionally for all jobs in which the cold fill pressure exceeds 18 psig. The pump-out plan puts the boiler and compression tank on the suction side of the pump; consequently starting the pump does not impose a significant increase of pressure on the boiler and, under some relationships of tank and boiler, may actually decrease the pressure in the boiler—a desirable condition. At the same time, starting the pump increases system pressure all the way round, thus making possible the use of a lower cold fill pressure.

Pumping out of the boiler to radiation at lower levels minimizes the amount of air reaching the pump as separation occurs naturally in the boiler. As further protection, an air separator, as shown in Fig. 6, should be mounted in the piping between the boiler and the pump.

How To Handle the Compression Tank

Since the size and location of the compression tank are related, sometimes we can take advantage of this relationship and by shifting the tank reduce its size. To illustrate, suppose we have projected a system designed to operate at 200 deg and, furthermore, that when cold filled, it contains 500 gal of water. The question is, should we locate the tank in the basement over the boiler, as shown in Figure 11, Arrangement A, or hoist it to the attic, Arrangement B?

The expansion will amount to

$$[0.00041 \times 200F] - 0.0466 \times 500 \text{ gal} = 17.7 \text{ gal}$$

The formula for calculating the tank size, as offered by the ASHRAE *Guide*, is:

$$\text{Volume} = \frac{E}{\left(\frac{P_a}{P_f}\right) - \left(\frac{P_a}{P_o}\right)}$$

where: E is expansion of the water, in gal
P_a is atmospheric pressure in the tank when filling starts, feet of water, absolute
P_f is minimum filling pressure, feet of water, absolute
P_o is maximum operating pressure at the tank, feet of water, absolute.

Now referring to Figure 11(A), the static pressure of the water column from the tank connection to the top of the system is 33 ft plus 4 ft to make venting positive at the top elevation; consequently P_f amounts to 33 plus 4 plus 34 for a total of 71 ft absolute.

P_o, the operating pressure, amounts to the setting of the relief valve on the boiler, say 30 psig or 69.3 ft of water plus 34, a total of 103.3 ft absolute.

P_a being the atmospheric pressure is equal to 34 feet absolute for the purpose of our example; actually this is subject to variation as the result of elevation above sea level and from barometric changes.

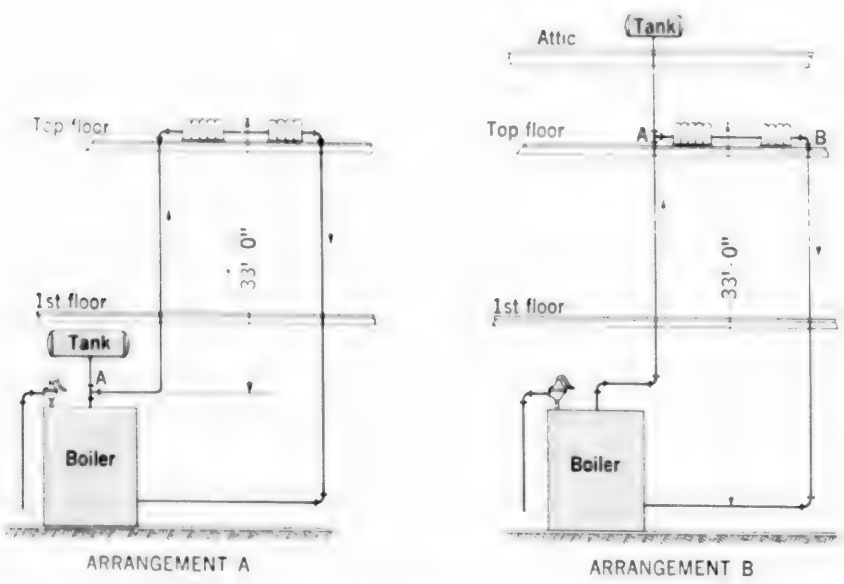


Fig. 11. Since the size and location of the compression tank are related, sometimes we can take advantage of this relationship and by shifting the tank reduce its size.

By setting these figures in the formula, we find the tank needed for Fig. 11(A) will require a volume of:

$$\frac{17.7}{\frac{34}{71} - \frac{34}{103.3}} = 118 \text{ gal}$$

Now let's try an attic location, "for size."

We don't have to worry about the vertical water leg between the boiler and the tank, because it's all below the tank and the static pressure it generates never affects the tank. However what we do need is the 4 ft to assure us of positive venting, plus enough additional head to neutralize the suction pull-down which occurs between the tank connection and the downcomer at point B in Fig. 11, Arrangement B. As we observed previously, the tank connection is a point of no pressure change insofar as starting and stopping the pump is concerned, but the system pressure decreases between the tank and pump suction, and we must allow for it in order to keep out of trouble. Suppose therefore we add another 4 ft for pump pull-down and, say, 3 ft for boiling insurance between the tank and point B; this gives us 11 ft at the tank as a minimum fill pressure. (Note: for an actual job, these friction losses would be determined accurately, not assumed or guessed.)

With a minimum fill pressure of 11 plus 34 ft absolute set into the formula, the volume of the compression tank can be cut to about 40 gal. This comparison explains why compression tanks are so often set high on the system; they save investment money by reducing the size of the tank.

We might observe here that tank capacities have been computed on the basis of the *minimum* fill pressure, as this produces the smallest tank on a hydraulically filled pressure system. Any increase of fill pressure above the minimum results in a tank of increased size. For example, if we pump *into* the boiler in Fig. 11(B) (a practice not recommended), the boiler pressure increases each time we start the pump and by an amount equal to the total pumping head less the friction loss between the tank connection and the pump suction. Assume that the total pumping head is 10 ft and 6 of these feet are accounted for on the suction side of the pump; then the pump discharge will impose 4 extra feet of pressure on the boiler every time it operates.

In order to avoid having the pump operation open the relief valves, this situation leaves us with 30 psig $\times$ 2.31 ft per pound minus 4 ft, or 65.4 ft above atmospheric. Correcting for the atmospheric pressure by adding 34 ft, we get 99.4 ft absolute as the cold fill maximum allowable on the boiler. Our tank volume thus becomes:

$$\frac{17.7}{\frac{34}{45} - \frac{34}{99.4}} = 43 \text{ gal, approximately}$$

Simply by pumping into the boiler instead of out of it, all other factors remaining unchanged, we add 3 gal or about 7½% to the required volume of the compression tank.

Compressed Air and the Compression Tank

By injecting air under pressure into the compression tank, we can economize on the tank size, a result that is the direct opposite of what happens when we depend entirely on water to establish the fill pressure.

To illustrate, suppose we start filling the tank, Fig. 11(A), against an air pressure of 5 psig. This is the equivalent of 11.55 ft of water above the atmospheric pressure of 34 ft, or a total P_a of 45.55 ft absolute. Setting this new atmospheric value in the formula gives us:

$$\frac{17.7}{\frac{45.55}{71} - \frac{45.55}{103.3}} = 88 \text{ gal, approximately}$$

Thus by charging the tank with 5 psig of compressed air, we can reduce the tank size by 30 gal (118 gal originally minus 88).

Is this worthwhile? It is if compressed air is available, or if a hand pump can be kept conveniently in the area. The tank must be equipped with an air fill valve, a pressure gage, and a water column to allow an intelligent estimate of conditions within the tank at all times. The air fill valve and the water column are desirable of course on tanks that fill against the existing atmospheric conditions, since water-logging must be discovered and corrected as promptly as possible.

To summarize, the compression tank should be located and sized with the objective of achieving the best practical economy.

II—Design for 1-Pipe Series Systems

1. This arrangement should be restricted to very small projects, and then only for those rooms or areas that can be temperature controlled as a unit. Reason: all the water must circulate through all the heat emitting units as parts of a single loop.

Because of its simplicity, a series layout can be very appropriate and useful as a branch or zone when incorporated in an installation of multiple requirements.

2. Care must be exercised in sizing the successive heat emitting units to compensate for the progressively cooling water. The practice of sizing the whole loop on an average water temperature has given rise to overheating in some areas, underheating in others. For best results, the heating demands on each unit should be determined accurately, and the heating surface apportioned accordingly. Figure 2 illustrates this.

III—Specific Recommendations for 1-Pipe Diversions

1. When the main is above the convector, radiator, or whatever unit is being served, diversion fittings should be used on both supply and return connections.

Reason: Hot water descending into a unit already filled with cold water must have enough pressure to force out the water of greater density and pursue it upward into the main. Unless the drop legs are short, say 5 ft or less, a single diversion fitting does not usually generate enough diversionary pressure at the main to do this. Once started, circulation through the heat emitting equipment is maintained readily.

2. Wherever practical, lay out a 1-pipe diversion system in two or more separate circuits, rather than one, in order to hold down pressure drop and thus save on pumping head. Figure 3 shows how.

IV—Specific Recommendations for 2-Pipe Systems

Since 2-pipe arrangements are best suited to large and complex installations using either direct or reversed return, we can examine their particular problems as a class.

First recommendation is to prepare a rough sketch or diagram on which are designated the individual zones, branches, circuits and loadings. By considering all the design-affecting factors, such as changes in elevation, obstacles to pipe locations, particularly favorable or unfavorable local conditions, the rough layout being modified as these modifications become necessary, we eventually develop a good conception of the overall problem. At this moment we know what we can and can't do, and moreover what we *must* do. Final layout and sizings then follow fast and smoothly.

2. In calculating the head on a circuit, make sure that the frictional resistance of the heat emitting unit is included. Surprisingly often, faulty heating is the result of an overlooked resistance in the convector, radiator, or whatever is being used.

3. For the sake of appearance, 2-pipe systems should be located, if possible, in non-conspicuous or concealed areas. This is not important as a rule in industrial jobs but will be rated essential for numerous commercial projects.

4. Don't neglect to caulk openings around pipes where a wall is penetrated. Use non-flammable materials such as asbestos, and finish with a metal shield. Sometimes required by the building code, it is desirable always for fire-stopping and sometimes for appearance.

5. It may be relatively economical to provide two or more compression tanks rather than to use a single large tank. Also, small tanks may fit better into the structural limitations of the building.

Control Considerations

Let's keep the controls as automatic as possible, and as tamper-proof as possible. The first consideration recognizes the need for commerce and industry to make a profit, and if a name on the payroll can be replaced by a scheme of thermostats and valves, the income-outgo balance is improved.

Tamper-proofing is essential because a complex and carefully balanced system, once thrown out of step by some uninformed control juggling, can incur substantial charges before correct performance is reestablished. The system designer, therefore, in determining the type and peculiarities of the controls to be adopted, should arrange for as much as possible to be kept under lock and key. Furthermore, in turning over the system to the owner, only one or two of the owner's employees should be authorized to make adjustments, those selected being carefully schooled beforehand in the operation and control of the entire system.

Techniques for industrial hydronic heating:

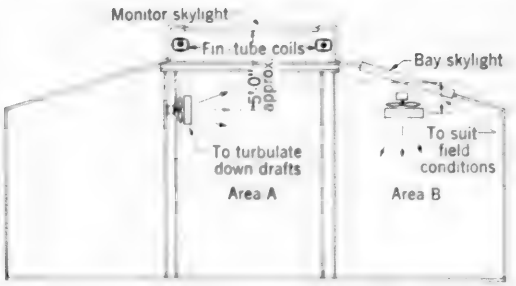


Fig. 12. Here are several methods for checking downdrafts caused by skylight glass.

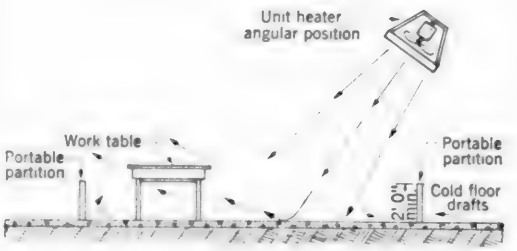


Fig. 13. Arrange piping and heater to avoid air pockets.

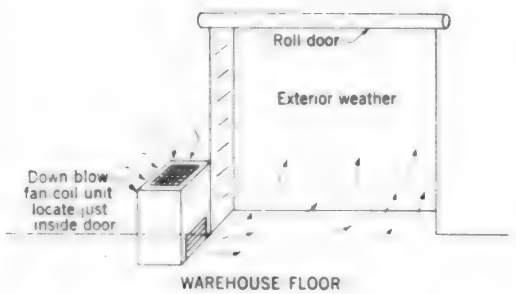


Fig. 14. A method of countering cold air from warehouse doors.

Why Commercial Controls Can Be Extensive

Not always, but frequently, commercial controls involve multiple monitoring devices, and here are the reasons:

1. Although temperature levels in a store or office building are fairly uniform, the need for ventilating air introduces fluctuations in ambient conditions that usually must be countered by providing several points of temperature control, or zoning. To illustrate, ventilating air on the shaded side of a building will have more influence on the heating in that area, than does similar ventilation on the sunny side, where surfaces are sun-heated and walls are warmer.

2. Subordinate control of the ventilating tempering coil is essential to protect the coil from freezing during periods of no hot water circulation. Whether an automatic shutter is installed, or whether the water drains automatically from the coil by means of a motor-operated valve, or however it is done, the arrangement is the prerogative of the designer. It just means another automatic control that is incorporated into the system.

3. Zoning required by hours of use is common. For example, some offices may require heating at night while shops or stores in the same building are closed, thereby producing a reduced and pinpointed load. Each zone, of course, must have its individual control.

Controls in industrial buildings range from the simple thermostat to a complex linkage of thermostats, timers, motor-operated valves, dampers, and so on. It all depends on the combination of type and frequency of heating needed. Methods for solving the problem will be discussed later in examining the heating for a loft building with a factory on each floor. For an extensive discussion of controls, see AIR CONDITIONING, HEATING & VENTILATING'S Reference Section, September, 1960.

The Effects of Large Glass Areas

Skylights. Usually encountered in industrial activities, skylight glass is most notable in its production of downdrafts. Here are several methods for checking this effect:

1. Install heating coils or other radiation as shown in Fig. 12, area A.

2. Provide under-the-skylight air movement from a unit heater or from a down-blow heater, as illustrated in Fig. 12, area B.

3. Double-glaze the skylight with an air space between the glass surfaces.

4. Use either 1 or 2 in conjunction with 3.

Note: similar techniques may be adopted to counteract the effects of glass in monitor side lights which also produce downdrafts if left alone.

Windows. Conventional practice in determining heating loads is to handle the windows like any other section of wall, making allowance, of course, for the greatly increased heat transfer coefficients of the glass. Practically, this is not quite adequate because of the effect the cold surface has on the occupants of the space, both animate and inanimate.

The coefficient of heat transfer by radiation, as stated by the Stefan-Boltzmann equation, varies not directly with the temperature difference, but with the 4th powers of the absolute temperatures. It looks like this:

$$q = 0.174 \cdot e \left[\left(\frac{T_1}{100} \right)^4 - \left(\frac{T_2}{100} \right)^4 \right]$$

where:

- q is heat transferred by radiation, Btu per unit of area per hr
- T_1 is absolute temperature of warmer body
- T_2 is absolute temperature of colder body
- e is surface emissivity, varying between 0.90 and 1.00.

Since the surface temperature of glass is relatively much lower than that of the framing walls, perhaps 40 to 58 deg, the temperature difference with an average human skin temperature of about 86 deg becomes 46 to 28 deg. The human metabolism can be quite capable of compensating for a difference of 28 deg in

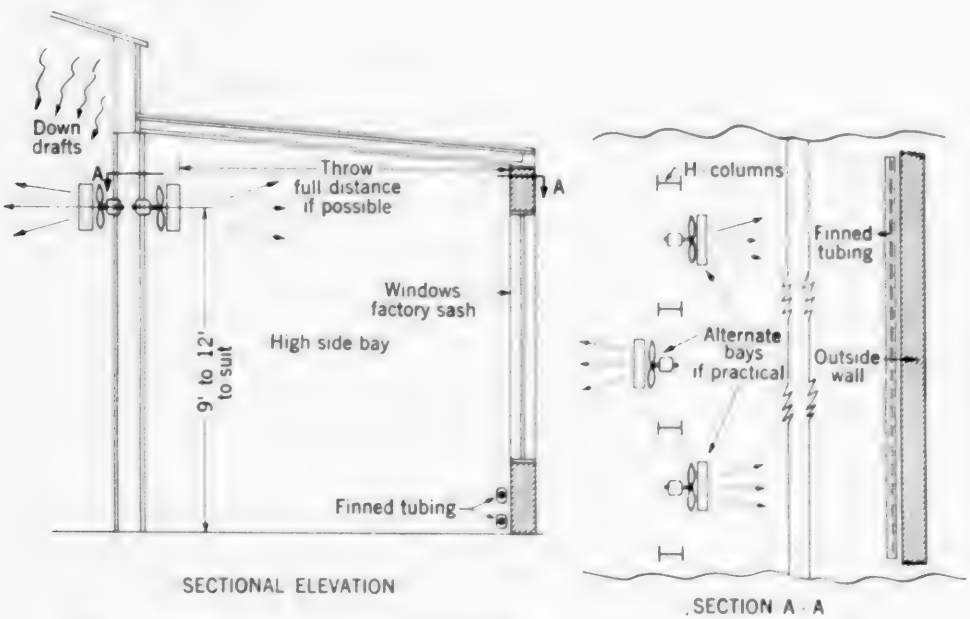


Fig. 15. A suggested heating arrangement for a high-bay industrial structure.

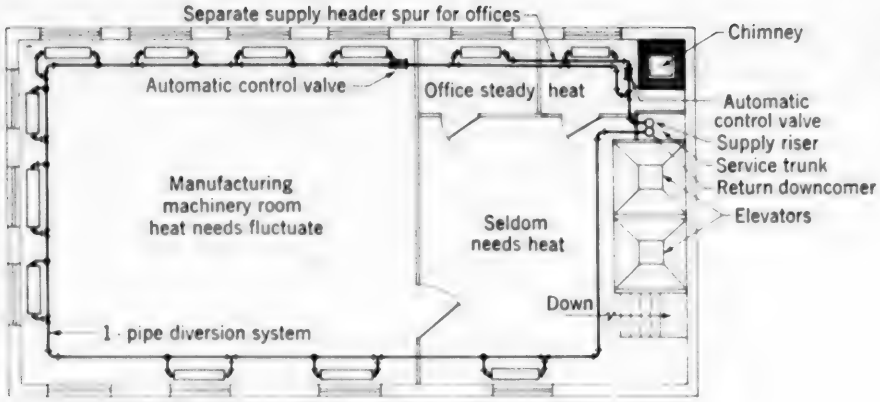


Fig. 16. Loft buildings have their own special heating problems, as seen here.

a small area of influence, but not for 46 deg when the subject is seated or in repose, and particularly since the effect is expressed in 4th powers.

The result is a condition long referred to as "cold 70" which means we have 70 deg on the thermometer and shivering subjects in the room.

Relief of the situation is possible in several ways. First we can double-glaze the windows, thereby elevating their inside surface temperature. Second, we can curtain the glass expanse, an experiment only partially successful since the inside surface of the curtains becomes a kind of compromise temperature between the glass surface and the temperature of the room. Third, and recommended, we can design for a higher inside temperature. This plan provides extra convective heat to make up for the excessive losses by radiation. For outside temperatures of 0 deg F, a 74-deg inside design is generally satisfactory for sedentary workers.

This problem is confined for the most part to commercial offices and banks, where the glass surfaces usually are large in relation to the framing walls, and there is little physical movement by the occupants. Windows in industrial plants upset the heat balance more by leakage than by the radiant transfer of Btu.

Small windows seldom need special attention.

Spot Heating with Hot Water

Since the philosophy of spot heating is to deliver comfort to a limited area of a generally cold space, a positive injection of warm air is preferable to such static expedients as convectors and radiators, pipe coils and such.

Overhead radiation that is not part of a fan distribution system must rely heavily on radiant heat transfer since natural convective movement is upward away from the job, and this radiant energy alone is seldom adequate to satisfy the demand. Its use, therefore, should be restricted to small, walled areas such as locker rooms, drying rooms, some storage rooms, and similar installations where drafts and air movement are not significant.

Unit heaters with fans are rated on free discharge, in accordance with the Code adopted by the ASHRAE and the Industrial Unit Heater Association. When this discharge is directed downward, the heater should be located as low as practical, always keeping in mind that a hot blow on the head is not appreciated by those obliged to work in it. A mounting height from 9 to 10 ft is probably the optimum from all points of view; if this is still too hot, the temperature of the output can be reduced. It should be approximately 60 deg higher than the ambient of the space being heated. Thus for a working area of 60 deg, a discharge of 120 deg should be about right.

Wherever possible, a partition, even if only 2 or 3 ft high, should be erected around the area being heated in order to stop horizontal floor drafts. The partition can be portable and taken out of the way when work in the area is not in progress.

A suggested slant discharge is shown in Fig. 13. The idea of this arrangement is to improve diffusion at head level as the result of the heater discharge rebounding after impact with the floor and other materials inside the partitions. It is a sort of compromise between the vertical down-blow and a horizontal blow at floor level, and avoids some of the draft annoyances characteristic of the two more conventional settings.

In sizing these heaters, a good but hardly perfect procedure is to estimate the volume of the space to be spot-heated, then provide from 20 to 30 air changes an hour. For example, suppose we have a floor area of 12 by 15 ft under a heater mounted 9 ft above the floor. This is 1620 cubic feet, and for a complete change every 2 minutes we'll need approximately 810 cfm of heater capacity.

If the space is fenced in with low partitions, we probably can do a good job with a smaller unit; every project must be evaluated on the basis of its individual conditions of draft and temperatures, and no general rule applies.

Spot heating puts a great deal of reliance on the judgment of the engineering mind that designs it.

Countering Cold Air from Warehouse Doors

This problem is solved in two phases. First, since the density of the outside cold air is much greater than that inside the warehouse, the cold air rolls in every time the door is opened; consequently we either must check the influx at the source, or so diffuse it with a

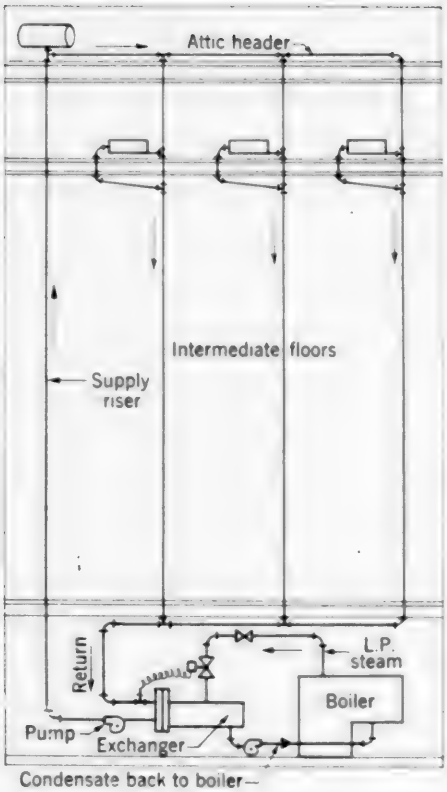


Fig. 17. The basement heat exchanger plan for loft buildings. The following points should be noted:

1. This is a 1-pipe diversion system, using a common supply riser and multiple vertical circuits flowing downward.

2. The arrangement could be reversed with a horizontal supply header in the basement and the returns descending by a common downcomer. However, the downflow plan is considered to be slightly better from the economy and operating viewpoints.

3. Supply riser is of uniform size. Downcomers increase in size to handle increasing load.

4. Two-pipe systems involve more piping and make more space demands.

warm blow that its chill is neutralized. Diffusion is the more practical, and the customary procedure is to direct a hot blow from unit heaters at the opening. This is intended to provide satisfactory mixing, but often doesn't.

We do not know of any way to achieve perfect neutralization, but the arrangement shown in Fig. 14 appears to have the merit of entering the conflict at a low level where the density of the inside air is greatest and the rising turbulence in that area affects the air at higher levels favorably.

The second phase of the problem is to provide the proper control. This means tying in the activation of the heaters, wherever they are, with the opening and closing of the door. The warm discharge should begin simultaneously with the opening of the door, and end with the closing. In fact, with motor-operated doors, a time-delay relay would help substantially in providing a few seconds of heating before the door leaves its seat.

What To Do with High Bay Buildings

The objective with these structures is to get some good from the heat before it takes off to the wide open spaces 20 or 30 ft overhead.

The conventional solution is to provide unit heaters set from 9 to 12 ft above the floor and with their blow directed toward the outside, cold walls. In some cases, the unit heaters are omitted in favor of direct-fired furnaces, but since we are concerned with hot water as the medium we'll confine our attention to hot water systems.

First, if downdrafts from skylights and monitors have been checkmated as previously discussed, the problem is a little easier. Second, if the opening and closing of big doors has been properly blanketed with heat, that is a big help also.

Convectors and radiators set along outside walls help in these situations for the warm convective currents, while rising with some vigor, do curtain the cold walls and windows with effective heat. In many factories this is all that is needed.

Figure 15 shows a suggested arrangement for this sort of structure. Note that the overhead unit heaters perform two functions: first, they break up and weaken the downdrafts from the monitors, and second, by having the blow sweep the underside of the side bays' roofing, heat loss in this area is countered to a substantial degree.

Techniques for a Loft Building

The special problems of a loft building are these:

1. Each floor may have one or more manufacturing concerns, and each concern has its own individual, and differing, need for heat.

2. The release of heat incidental to the manufacturing activities may affect the controls on a seasonal, daily, or even hourly schedule.

3. Special equipment on the various floors can make the effective placement of radiation difficult.

4. For floors above the 4th or 5th, depending on the height between floors, a low pressure circulating system originating in the basement is not practical. This is because the static pressure on the boiler, plus the pressures of operation, are almost certain to exceed the conventional 30-psig working pressure of the boiler.

Solution of problems 1 and 2 is illustrated by Fig. 16. Through spur headers and sectional controls, we can stop the circulation to a section of the floor that has no need for heat at the moment, and thus achieve local control without serious disturbance to the remainder of the system.

For solving special problem number 3, we might be obliged to keep all heating facilities overhead. Unit heaters might or might not be applicable, depending on the height of the ceiling and obstructions in the line of blow. For long ceilings, a run of duct enclosing a heating coil and having side outlets to avoid a downblow on workers is an expedient to consider, although exposed beams can make such an installation difficult.

For buildings over five stories, we have several alternatives. Probably the most common is to combine a steam boiler in the basement with a heat exchanger. This scheme allows the boiler to operate at low steam pressure, under 15 psig, while the heat exchanger, piping, valves and other components of the water loops may be operated at medium pressures as the situation dictates. A heat exchanger at 4- to 5-story intervals has been used in some instances to maintain low pressures throughout, but this is more expensive.

Figure 17 illustrates the basement heat exchanger plan.

Another possibility is to use a boiler suitable for pressures above 30 psig. The result will be a system that is low in pressure only at the high spots—where static pressure is relatively low. This plan is sometimes favored for jobs that are just above the low pressure limits. Buildings from 4 to 6 stories often come in this critical class, and how we handle the situation depends on a combination of economics and the physical peculiarities of the building.

A point to consider in high buildings is that the vertical service trunks are likely to be crowded with sanitary piping, electric cables, water and fire piping, and possibly some telephone facilities.

Since a low pressure steam riser bulks larger than an equivalent hot water pipe, the higher pressure hot water boiler would appear preferable because of space saving in the trunk. There is also the questionable economy, for a design that uses upper level exchangers in the maintaining of low pressure throughout, of providing floor space for converters and pumps. These would encroach on the revenue-producing floor areas, and consequently would not be regarded happily by the building owners.

The point is that high buildings may involve some sort of compromise between pressures acceptable and space allocated.

Hot Water and District Steam

This is a familiar combination in many large cities. Figure 18 shows a typical steam-to-water connection.

The important consideration for a hydronic designer is that district steam simply replaces the boiler with another source of heat for elevating the temperature of the water. All the usual hot water problems, such as locating the compression tank and pump, and the selection of operating pressures, must still be solved.

Slick Tricks for Sound Performance

The installation of a hydronic system offers many small opportunities for the employment of piping wisdom. A good job isn't good enough if we know how to do it better. To some, the following tricks for improving installation practices will not be new; however, many newcomers to the field can observe them with profit:

1. When a run of hydronic piping must cross a beam or other obstruction at a conflicting level, route the piping *under* the beam, not over it. Figure 19 shows how this idea prevents the formation of an air pocket at this point.

If the pipe crosses *over* the beam, that point becomes a high point on the run and provides a resting place for bubbles of air. Trouble will be almost certain to develop eventually unless the over-the-beam arrangement is vented at that point.

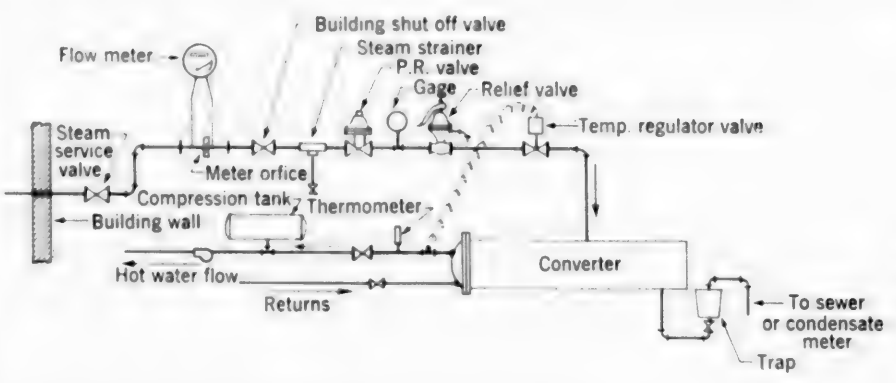


Fig. 18. Typical steam to water connection. If condensate meter is used, flow meter orifice and connections are omitted.

"Slick tricks" for sound performance:

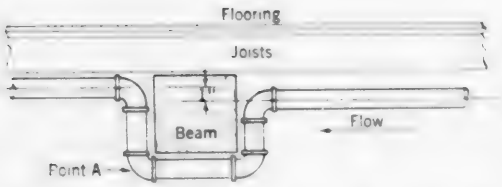


Fig. 19. The difference in elevation between the piping on each side of beam is not mandatory, but it is recommended as an extra asset whenever practicable.

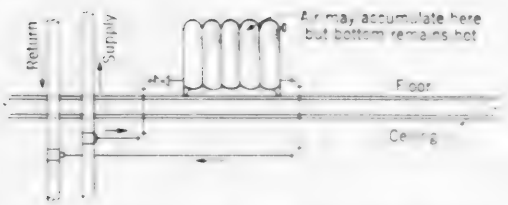


Fig. 20. Making both supply and return connections low doesn't stop air from accumulating at the top, but it does keep most of the radiation warm.

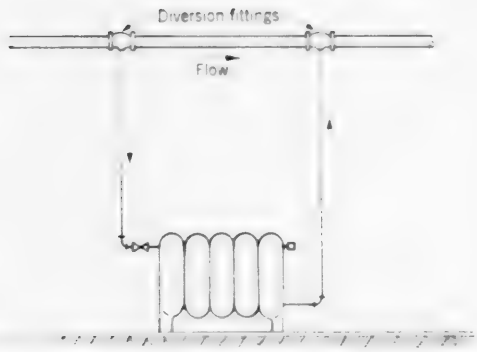


Fig. 21. With this method, air in radiation can escape upward to main from which it is removed by the separator and automatic vent valves on the system. Air removal from convectors occurs similarly.

2. Connecting the supply pipe to the *upper* part of the radiator when the supply originates at or under the floor allows air to accumulate in the top of the radiation and gradually choke off circulation. Making both supply and return connections low doesn't stop air from accumulating at the top, but it does keep most of the radiation warm. Figure 20 illustrates this type of installation.

3. When the radiation is *below* the main, we should be careful to connect the supply into the top of the radiation, the return to the bottom. This path of flow allows the gradually-cooling water to sink to the bottom of the radiation, doing all the heating possible before returning to the main above. See Fig. 21.

4. When unit heaters are supplied with hot water from a main lower than themselves, each must carry its own automatic vent. Otherwise the heater becomes a natural air pocket.

5. Change the size of horizontal mains with eccentric reducers in order to cause the top of the pipe to pitch smoothly to the desired high point. Concentric reducers create air pockets we can better do without Figure 7 illustrates.

6. In making up screwed pipe joints, use dope on the male threads only. This keeps the dope from being pushed into the pipe where it can be picked up by the circulating water and deposited in undesirable locations.

7. Experience indicates that the upside-down placing of valves is best avoided. A valve in this position develops leaks and needs service earlier than when installed upright.

8. The closer to the boiler we can set the pressure-temperature relief valve, the safer we will be. Because a valve mounted several inches above the boiler does not register true temperatures in the boiler but occupies a cooler location, it may not open when it should. Valves that must be so mounted can be obtained with an extension bulb that penetrates into the boiler water, and therefore are desirable from a safety viewpoint.

Four Vital Rules of Good Design

1st Rule: Size the compression tank *accurately*.

2nd Rule: As may be practical, locate the pumps to impose most of the total pumping head on the discharge of the pump, rather than on the suction side.

3rd Rule: Wherever the high point of a circuit is subject to pressure pull-down as the result of starting the pump, provide enough extra fill pressure to compensate for this amount of pull-down. The purpose is to guard against boiling and the possible in-drawing of air.

4th Rule: Provide adequate air separation and venting to avoid depreciated heating and possible noise and cavitation in the pumps.

There are other precepts worth observing as we have noted in some detail in preceding sections of this article. Proper handling of these four, however, will produce a system that is fundamentally sound; improper handling is almost certain to be followed by erratic and questionable operation.

FOREIGN SUMMER DESIGN TEMPERATURES

The following summer design temperature data are reproduced by permission from *A Guide to Current Practice, 1959*, The Institution of Heating & Ventilating Engineers, Great Britain. They are based upon information from the Meteorological Office of the Air Ministry, London.

These data may be used when more detailed investigation is not possible. Design dry-bulb and wet-bulb temperatures are derived by an Approximate Method, as follows:

(1) That month is selected as the Design Month which has the highest average monthly dry-bulb temperature, this temperature being taken as the design dry-bulb temperature for that locality.

(2) For the same month, a vapor pressure is derived from the average daily maximum dry-bulb temperature and the average daily minimum relative humidity. This vapor pressure is associated with the design dry-bulb temperature to produce the design wet-bulb temperature.

Design temperatures so obtained are less than the extreme conditions. In normal air conditioning design, the time lag of the building structure makes it unnecessary to design for a more severe condition than that given by the approximate method. However, it may be necessary to employ a higher wet-bulb design temperature in the design of cooling towers than this Approximate Method gives.

Data for North America are reproduced to enable the reader to compare design temperatures computed by the Approximate Method just described with design temperatures with which he is familiar. For instance, design dry-bulb and wet-bulb temperatures given here for Los Angeles, Calif., are 96 and 74 deg F, respectively, while the corresponding suggested summer design temperatures in use in the United States are 90 and 70 deg, respectively. Approximate design temperatures for New York, however, are only one degree higher, in each case.

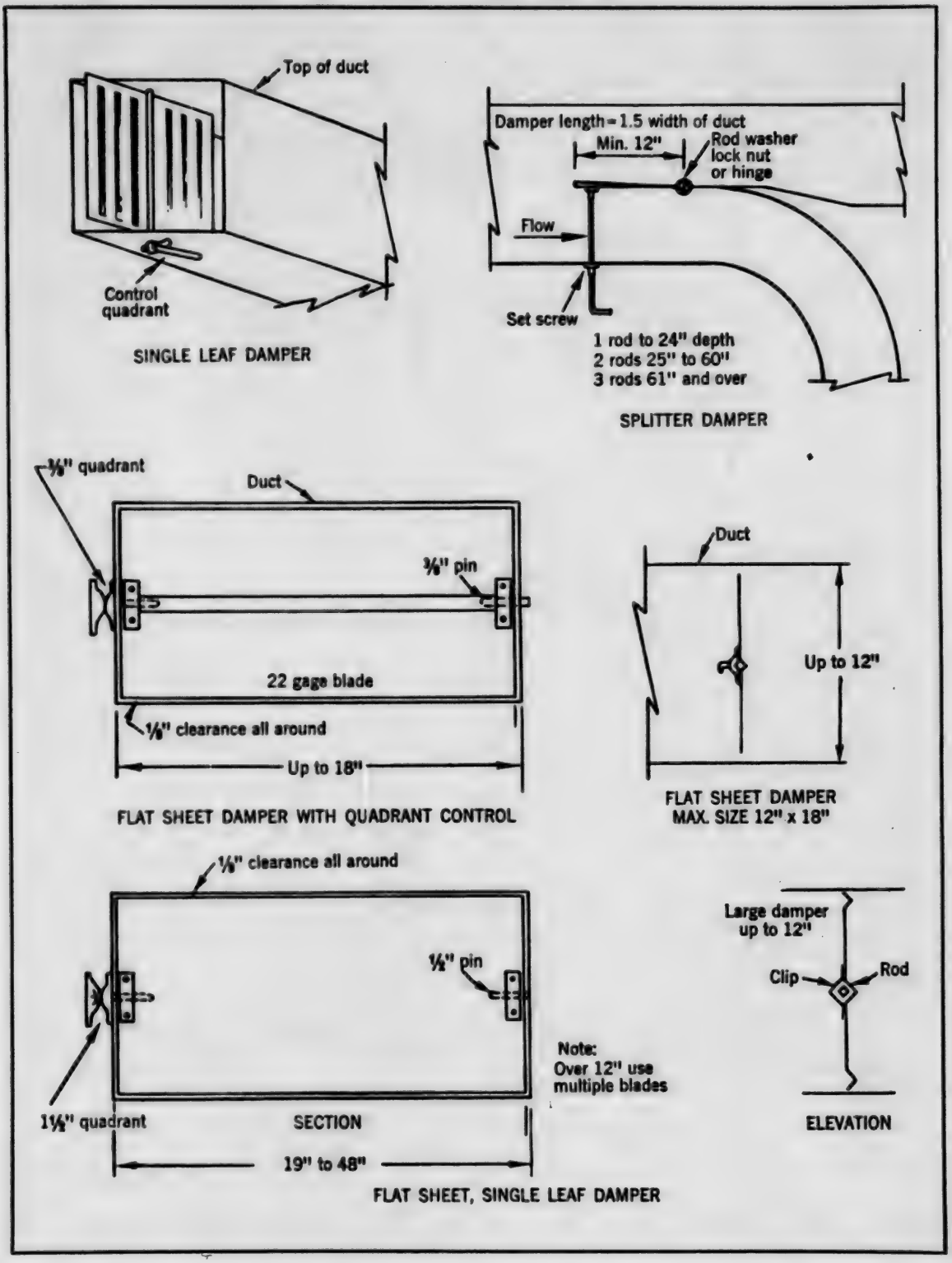
Country and City	Ground Elevation, Ft.	Design Month	Design Temp. deg. F		Av Diurnal Range, deg. F
			Dry Bulb	Wet Bulb	
North America					
Canada					
Montreal	187	July	89	70	17
Ottawa	339	July	92	73	23
Toronto	379	July	91	72	20
Vancouver	45	July	84	69	20
Mexico					
Mexico City	7575	June	82	66	21
U.S.A.					
Chicago	823	July	94	75	15
Los Angeles	312	Sept	96	74	23
New York	314	July	96	76	16
San Francisco	52	Sept	85	68	14
Washington, D.C.	72	July	97	77	19
Europe					
Austria					
Salzburg	1435	July	89	70	19
Vienna	664	July	88	69	16
Balearic Island					
Palma de Majorca	75	July	94	77	18
Belgium					
Brussels	328	July	87	70	19
Corsica					
Ajaccio	243	July, Aug	93	75	21
Crete					
Candia	98	June	95	75	15
Cyprus					
Famagusta	75	Aug	107	82	24
Nicosia	716	Aug	104	76	28
Czechoslovakia					
Prague	662	July	89	67	16
Denmark					
Copenhagen	43	July	82	68	17
Finland					
Helsinki	30	July	81	67	14
France					
Bordeaux	157	Aug	94	73	23
Brest	56	Aug	83	71	14
Lyons	938	July	93	72	22
Marseilles	246	July	91	71	20
Paris	164	July	90	70	21
Germany					
Berlin	187	July	89	69	19
Cologne	184	July	87	69	15
Hamburg	66	July	82	66	13
Leipzig	410	July	88	70	18
Munich	1739	July	85	67	18
Gibraltar					
North Front	11	Aug	94	76	14
Greece					
Athens	351	July	99	72	18
Salonika	78	July	99	78	20

Country and City	Ground Elevation, Ft.	Design Month	Design Temp. deg. F		Av Diurnal Range, deg. F
			Dry Bulb	Wet Bulb	
Hungary					
Budapest	394	July	94	71	22
Iceland					
Reykjavik	92	July	66	57	10
Irish Republic					
Mullingar (48 miles N.W. Dublin)	355	July	77	66	16
Valentia (70 miles W. of Cork)	30	July	71	63	9
Italy					
Florence	121	July	98	76	23
Genoa	318	July	90	75	10
Milan	465	July	94	73	22
Naples	220	July	94	76	14
Rome	377	Aug	96	74	21
Venice	13	July	90	76	14
Malta					
Valetta	233	July	95	77	12
Netherlands					
Amsterdam	5	July	83	67	10
Rotterdam	12	July	87	69	12
Norway					
Bergen	141	July	75	67	21
Oslo	308	July	81	67	17
Poland					
Warsaw	394	July	89	70	19
Portugal					
Lisbon	313	Aug	94	71	16
Oporto	328	Aug	94	74	19
Rumania					
Bucharest	269	Aug	97	72	26
Sardinia					
Cagliari	3	July	96	78	19
Sicily					
Messina	167	Aug	95	77	15
Palermo	354	Aug	98	77	22
Spain					
Barcelona	312	Aug	90	75	13
Corunna	177	July	81	69	13
Madrid	2188	July	96	72	25
Seville	98	Aug	107	82	29
Sweden					
Stockholm	146	July	81	66	15
Switzerland					
Basel	1040	July	93	73	22
Bern	1877	July	86	69	18
Geneva	1329	July	90	71	19
Turkey (in Europe)					
Istanbul	59	July	93	74	16
United Kingdom					
Birmingham (Edgbaston)	535	July	81	67	15
Castle Archdale (70 miles W. of Belfast)	225	June	75	63	13
Glasgow (Renfrew)	29	July	76	64	14
Liverpool (Bidston)	198	July	78	65	11
London (Kew)	18	July	82	66	16
European U.S.S.R.					
Leningrad	16	July	83	67	14
Moscow	505	July	88	70	21
Yugoslavia					
Belgrade	453	Aug	98	74	23
Africa					
Algeria					
Algiers	194	Aug	99	79	14
Aoulef	902	July	118	79	28
Colomb Béchar	2523	July	107	76	26
Oran	36	Aug	95	80	12
Touggourt	226	Aug	115	85	30
Angola					
Cabinda	98	Mar	91	81	14
Luanda	194	Apr	89	81	10
Moçâmedes	10	Apr	91	78	16
Vila Luso	4331	Nov	89	75	23
Bechuanaland					
Ghanzi	3711	Jan	98	75	26
Maun	3091	Jan	98	77	24
Cameroun					
Douala	26	May	90	82	13
Chad					
Faya (largeau)	837	May	117	81	36
Fort-Lamy	968	May	110	79	27
		July	103	83	20

(The table is continued next month)

VOLUME DAMPERS

Details of Design and Installation

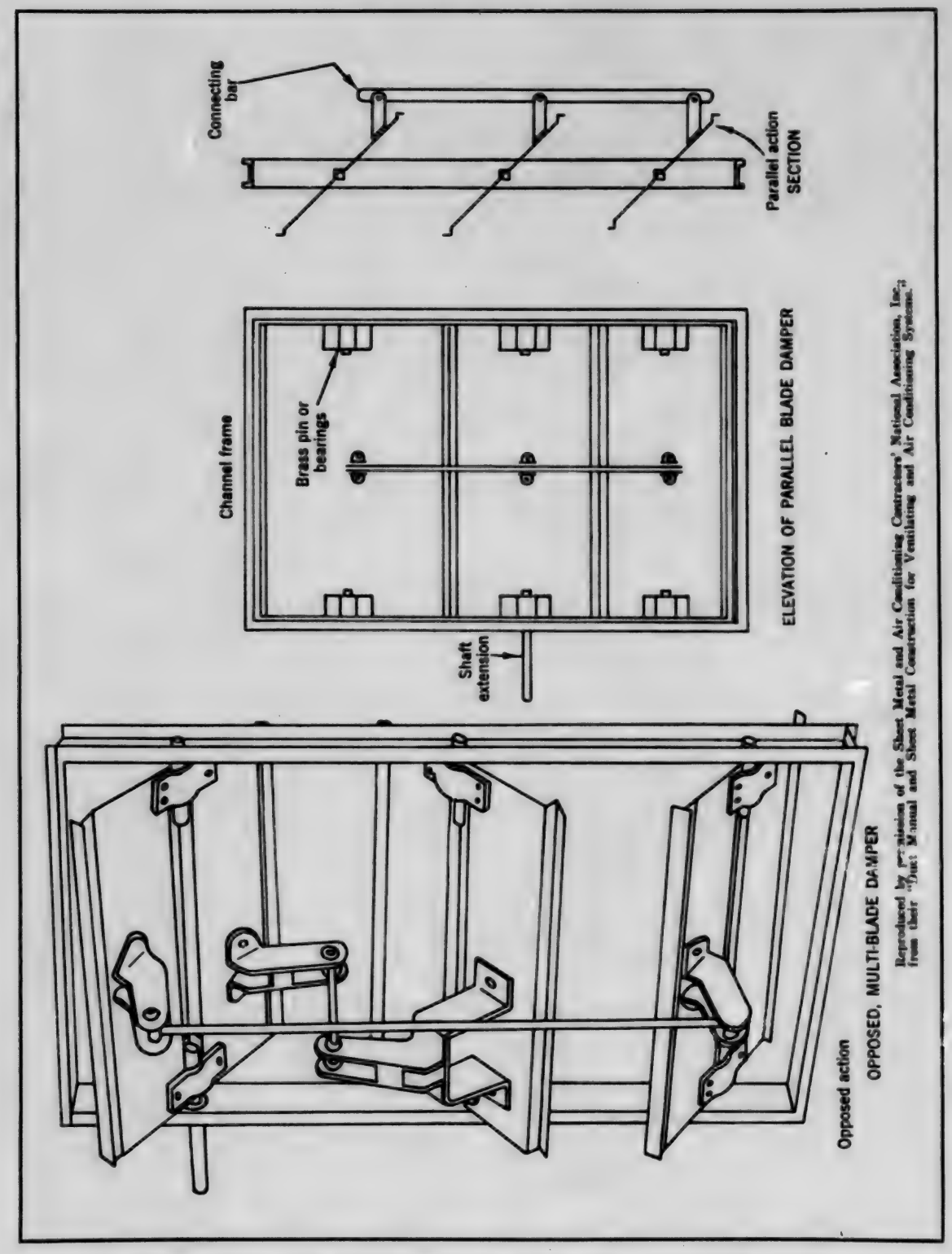


DETAIL SHEET—AIR CONDITIONING, HEATING AND VENTILATING

December, 1960

MULTIPLE BLADE VOLUME DAMPERS

Details of Design and Installation



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DETAIL SHEET—AIR CONDITIONING, HEATING AND VENTILATING

December, 1960

Holding Comfort Conditions at Low Loads

Systems can be designed to operate smoothly and dependably at a capacity that will match the load, no matter what the variation.

TOO often, heating and air conditioning engineers specify only maximum requirements, although heating and cooling systems operate for most of their life at off-peak conditions. Little thought is ever given to the lowest capacity needed.

Because the change from cooling to heating is often so gradual, operation of either type of equipment is frequently required at only one or two percent of maximum capacity. Failure to provide for smooth operation at low and intermediate capacities is the cause of many a disappointing installation.

There are, basically, two ways to match a system's performance to the varying loads imposed on it: (1) operation of equipment intermittently at full capacity, so timed that the average of full on and off equals the demand; (2) continuous operation at variable capacity, so controlled that, in the ideal, at least, output always equals the demand on the system. The first method is the simpler, but is rarely applicable to large installations.

Heating Systems Less Troublesome

In general, heating systems are less troublesome to control than air conditioning systems because they are inherently less sensitive. That is, the controlled medium, hot water or steam, may vary in temperature or pressure to some extent, in most cases, without immediately affecting conditions in the conditioned space. In addition, there is often a large storage capacity in hot water or steam generators and associated piping that smooths out fluctuations in temperature of the water or pressure of the steam. The combination of permissible temperature or pressure variations, and a built-in resistance to such variations, enables one to apply on-off controls to the firing mechanism providing that the load is relatively constant. Residential hydronic heating systems are a good example of this.

Large heat storage capacity, however, may present a problem in adjusting to *changing loads*. Intermittent, full-capacity operation of a panel heating system, with pipes embedded in the structure, is a case in point. If control is provided to avoid excessive panel temperature, and outside temperature suddenly drops, the

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ABOUT THE AUTHOR AND THE SEMINAR

Melvin A. Ramsey is no stranger to readers of Air Conditioning, Heating and Ventilating, who know him through the pages of the magazine, heard him at numerous meetings of technical societies, and met him on the job, where, as consulting engineer for Air Conditioning and Refrigeration Division of Worthington Corporation, he has contributed his considerable experience to the solution of many difficult design and installation problems.

In this and in succeeding monthly installments, Mr. Ramsey, a licensed professional engineer in New York and New Jersey, selects for discussion those aspects of air conditioning and refrigeration design which he finds are giving engineers the most trouble. In so doing, he draws from experience that dates back to 1927, when he was a designer and estimator for Baker, Smith & Company of New York City.

Inquiries for more information about the topics already covered, or for technical information on other topics in his field, addressed to the Editor, will be happily passed on to the author, who, as visiting instructor at Newark College of Engineering and Stevens Institute of Technology, thrives on them.

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limiting panel temperature may be reached before room temperature rises sufficiently to actuate the room thermostat. Additional control should be provided to take care of this. Again, a hot water heating system with cast iron radiators has a considerable heat storage effect. The stored heat is likely to continue to pour out into the space although the thermostat has been satisfied and the burner turned off. A heat-anticipating thermostat used in conjunction with on-off control is likely to provide satisfactory control for such a system.

Intermittent Controls for Cooling

Cooling media, unlike heating media, cannot be permitted to change temperature with the same degree of freedom because it is called upon to perform both cooling and dehumidification functions simultaneously. Whether we are talking about chilled water or direct expansion, the necessity for maintaining the temperature of the medium within fairly narrow limits restricts the range of application of on-off control. This is so because, in an attempt to hold media temperatures constant, equipment cycles excessively, a situation which tends to shorten equipment life. Another reason is that refrigerant temperatures are often close to the point where freezing of moisture on the coils might occur if the temperature were allowed to fall.

Intermittent, full-capacity operation is used, however, in the cooling of small spaces where the sensible heat ratio is high and the occupant is accustomed to accept less than rigid control of his environment. The ordinary residence fits this description. Small stores and offices may have high internal sensible loads, compared to latent loads, due to a large amount of artificial illumination or sun load from large glass areas; in this case, once the thermostat is satisfied, the entire conditioning system can be shut down for a period, air sensible temperature allowed to rise during this period, and in the meantime excessive humidities are not likely to build up. The large sensible load might be thought of as reheat. Other small spaces may be deliberately provided with reheat and thus lend themselves to intermittent control.

Step capacity control is a variation of on-off, or intermittent full capacity control. In heating systems, it might take the form of two or more boilers in parallel. A multiple-compressor installation is its counterpart in air conditioning. During light-load conditions one or more units are shut down, and on-off control is applied to the remainder. The more units, or steps provided, the closer capacity can be matched to demand and the less frequent is the cycling.

Continuous Operation at Variable Capacity

An increasing number of air conditioning installations, whether operating on heating or cooling cycles, cannot be controlled by intermittent full-capacity operation or by intermittent part capacity operation except at the cost of excessive cycling of oil burners, compressor unloaders, or compressors. Examples of these include:

1. Larger air conditioning systems where two or more air handling units are supplied from a single heat source or refrigeration circuit, whether or not refrigeration is supplied by one or more compressors;
2. Units which provide steam, warm or chilled water, to air conditioning unit coils. The mass of the system tends to reduce the frequency of cycling, but the conditions to be maintained may require that water temperature be held very close to a predetermined point;
3. One or more air handling units using modulating damper control. Multizone units make the problem a little worse; and
4. Air conditioning systems using all or large proportions of outside air, which results in a large variation in the condition of air entering the coil.

Steady Partial-Capacity Refrigeration

When a refrigeration machine's capacity can be varied gradually, as in the case of a centrifugal compressor, steady partial-capacity operation is easily achieved. The only thing to check is whether or not compressor operation will be stable at the capacity corresponding to minimum load. If not, a hot gas bypass to the evaporator can provide sufficient artificial load to give stable operation, even though the actual load falls to zero.

Reciprocating machines, with their relatively constant suction and discharge pressures, have limited capacity steps. Increasing the number of compressors provides more steps, but these steps are often not close enough. When the load is between two steps, the system cycles between the two points in order to match the load.

For example, suppose that capacity steps of 25, 50, 75, and 100% are available and the load is actually 60% of full capacity. The compressors can provide this 60% by operating part of the time at 50% of capacity and the remainder of the time at 75% of capacity. If the storage effect, or the permissible variation in suction pressure is large enough, the cycles may not be too frequent for unloaders. With multiple compressors only to provide the steps, the acceptable frequency of cycling is reduced, because a compressor must not be started or stopped too often.

When there are two or more compressors, each with unloaders, the situation may arise where the number of changes per hour may easily be handled by the unloaders, yet, because operation is close to a point at which a compressor must be stopped and started, the frequency of change is injurious to the compressors. The solution is to so arrange the controls that the loading and unloading sequence is altered with the result that operation at any capacity, between full and minimum (one compressor in operation, fully unloaded)

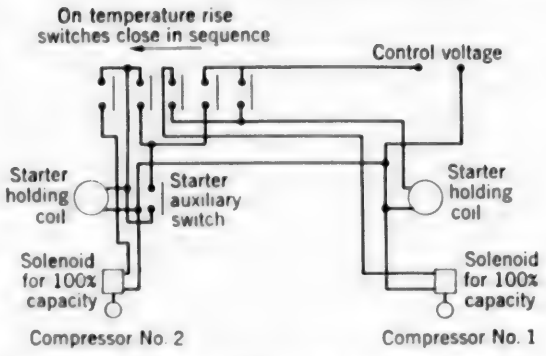


Fig. 1. When the system calls for a capacity increase, compressor No. 1 starts at 50%, then loads 100%. Compressor No. 2 starts at 50%, loads to 100%. Upon a call for decreasing capacity, the sequence is reversed.

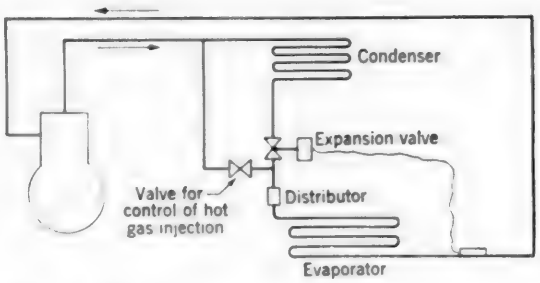


Fig. 2. When desired, hot gas gives the evaporator an artificial load. Hot gas is taken from main discharge of compressor and brought to evaporator through a tee installed between the discharge of the expansion valve and the distributor. Valves and distributor must be sized correctly.

occurs with the cycling of unloaders, but not compressors. Fig. 1 shows one method. If the load may be less than the capacity of one unloaded compressor and it might cycle in excess of about six starts per hour, further means must be taken to eliminate this unstable condition.

Handling Very Low Loads

If the load is less than that corresponding to the capacity of one, unloaded, compressor, then the controls cannot prevent cycling. There are, however, several methods for maintaining satisfactory operation at these very low loads:

1. A back pressure regulator can maintain an approximately constant evaporator pressure while compressor suction pressure falls, reducing compressor capacity. This permits operation at about one-half to one-third of compressor minimum capacity at about 40 deg F suction. The back pressure regulator must be sized to pass the gas at the maximum rate with a low pressure drop, in the order of 2 or 3 psi, and permitting the minimum flow at the large pressure drop that will then be required. It may be necessary to have two or more valves in parallel.

2. A "balance loader" can effectively provide for zero net capacity by using hot gas to provide artificial load equal to minimum compressor capacity.

3. Use of a hot gas bypass will provide zero net capacity in either of two ways:

(a) The gas is taken directly from the main discharge and brought to the main suction through a constant-pressure expansion valve. A liquid spray, controlled by a superheat control valve, cools the gas to prevent it from overheating the compressor. Operation of this combination of valves must be such that the sprayed liquid completely evaporates before entering the compressor.

(b) Hot gas is taken from the main discharge of the compressors and brought to each evaporator through a tee installed between the discharge of the superheat-controlled expansion valve and the distributor. An appropriately sized constant-pressure expansion valve controls the gas flow. Normally, a separately controlled bypass would be made to a tee at the outlet of each expansion valve in the system. See Fig. 2.

Each of these methods has advantages for a particular installation. Sometimes, when close control of evaporator pressure is required, a back pressure regulator may be used with the hot gas bypass. Control of the constant-pressure valves would then be based on the suction pressure at the compressors.

Whatever method is used, it must be combined properly with any compressor capacity control. Some controls vary capacity in proportion to the changing suction pressure. Others make no changes in capacity unless suction pressure reaches the lower or upper control point. At the lower point, capacity is cut out until the pressure rises above that point. At the upper point, capacity is added until the pressure falls below that point.

In most cases, load changes are slow, so that a well-designed system will operate at one capacity point for a considerable period. Where load changes are frequent and wide, facilities must be provided to accommodate this condition or the system must be provided with a flywheel effect.

Conclusion

The purpose of the foregoing discussion was to make it clear that systems can be designed to operate smoothly and dependably at a capacity that will match the load, no matter what the variation. This is true for all heating and refrigeration systems. The importance of designing for minimum as well as maximum requirements has been stressed. In addition, the type and rate of variation between extremes should be anticipated, as the allowable variation of conditions in the maintained space limits the temperature fluctuations at which heat or refrigeration is supplied.

Chemical Conditioners Called Matchless For Match Production

W. C. DELPH AND J. L. GLIM
Engineers, Superior Match Co.

SUPERIOR Match Division, of K.V.P. Southerland Corporation, was faced with a problem. It wanted to increase its entire production facilities, hold its competitive position in the industry, keep up its reputation for quality, and at the same time reduce the cost of production. Space limitations at the Chicago area plant brought about the decision that modern manufacturing methods called for the new modern plant in Frankfort, Ill.

Matches are such a low price item that it is vital to manufacture them at a very high rate of production and at a low cost. Therefore, the process must operate continuously without production stoppages at any time. The production of paper back matches employs several steps, as follows:

Jumbo rolls of paper are fed through a die-cutting operation which forms the match stems in length, and inserts these match stems, or combs as they are called, into a conveyor. Each comb is first given a parafin wax dip, then a carefully controlled dip in the flamable match head composition. The combs continue traveling, after being dipped, into a drying area wherein the temperature and relative humidity are closely controlled. The texture and quality of the match heads are dependent upon these drying conditions; therefore it is necessary to hold them within very close limits. After drying, these match combs are automatically ejected from the conveyor and carried to the final assembly area by means of another conveyor.

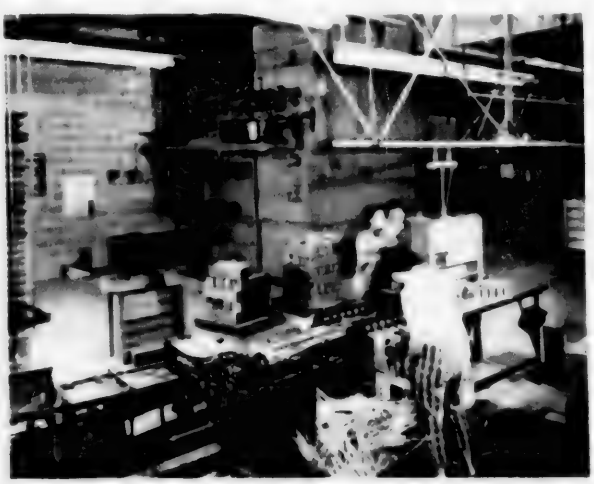
The covers for the matches are manufactured separately and entail from one to five-color printing, requiring very close color registration. Paper, susceptible to moisture, expands and contracts under varying humidity conditions, and unless a careful control of the manufacturing area's atmosphere is maintained, it is very difficult to do quality printing. The match covers are printed in multiples. The match striker emulsion is applied and they are then dried at an accelerated rate. The covers are then cut or split to the respective match book sizes.

The final assembly of these two components is accomplished on automatic machines, at the rate of approximately 30,000 match books per hour for each machine.

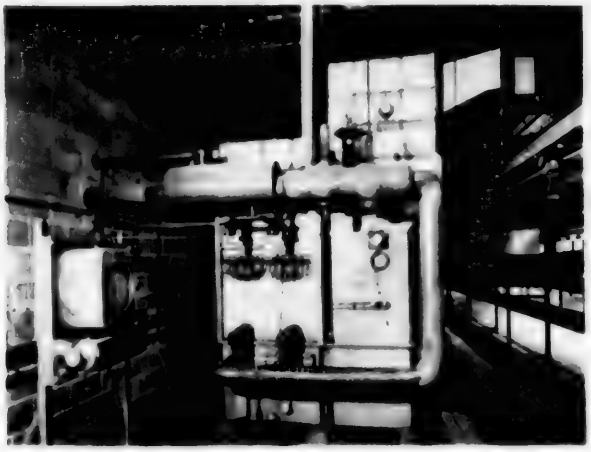
With careful control of humidity and temperature, all of these operations can be carried on far more consistently without any regard for the outside weather conditions, assuring the company of a high-rate of production without stoppages. Since the conditions ideal for the manufacturing of the matches are also ideal for human well-being, the physical comfort experienced by the personnel of these areas has also been found to be an important factor in high productivity.

The requirements of mechanical refrigeration for

This is the area where final assembly of matches and covers is accomplished on automatic machines in a temperature- and humidity-controlled atmosphere.



One of the Hygrol air conditioners is seen at the rear of this trimming operation.



Heart of the match production is the drying area where chemical dehumidification is again employed.

conditioning the printing and assembly rooms, if it were used here, would be approximately 300 tons. In view of this, it was decided to use the principle of chemical dehumidification, as employed by the Niagara Blower Company's Hygrol system; that is, the use of a liquid desiccant which removes moisture from the air by absorption. Superior's previous experience with other dehumidification systems found corrosion to cause a great maintenance problem in this application. The Niagara system employs a stable organic liquid, non-corrosive in character and not easily contaminated. The use of this system in this area not only saved the manufacturer approximately 53% of the initial cost of a refrigeration system, but also the cost of approximately 200 hp while operating during the hottest summer months, and even more during the remainder of the year. The cost of electricity for this purpose in this area is approximately $80 per horsepower.

The printing and assembly areas occupy 762,000 cu ft, and are conditioned by three Hygrol units, each unit handling 20,000 cfm of air and each unit equipped with a spray cooling coil, using water as a refrigerant. The conditioners are also equipped with a 20-ton aftercooling coil, using F-12 as the refrigerant for the purpose of handling peak dry bulb temperatures. Niagara evaporative condensers are used in conjunction with F-12 compressors to produce maximum water savings. The conditioning units offer a means of controlling the dew point as well as the dry bulb temperature in the conditioning areas independently. In the wintertime by using preheat coils for fresh air as well as reheat coils, all incorporated in the same conditioners, the system adds heat and humidity during the cold weather season with the same precise control as it cools and removes humidity during hot weather.

Heart of the match production is the drying room. Here the matches travel on a continuous belt, 200 ft long, drying after they have been dipped in the match composition. In this area, approximately 387 lb of moisture is removed from this room each hour. To handle this task, chemical dehumidification was again applied. The conditioning unit handles 13,000 cfm and is used in conjunction with a 75-ton F-12 compressor and an evaporative condenser, again being used in line with water conservation. The compressor employs four steps of unloading to allow this system to operate automatically at the minimum horsepower required for the job. This system saves 30 hp over the requirements of a strictly mechanical refrigeration system. However, in this application the use of mechanical refrigeration would be difficult because of frosting of the coils, which would occur at the low dew points required.

The warehouse area is the location of all of the F-12 compressors and their evaporative condensers. The evaporative condensers are used to ventilate this area in the summertime, while in winter they help supplement the Niagara space heaters in the area, adding both heat and humidity as required. Two concentrators, also located in this area, are used to remove moisture from the two separate Hygrol systems, one unit removing 610 lb per hour of moisture from the three conditioning units in the printing and assembly room. The second concentrator removes 387 lb per hour of moisture from the system handling the match drying room. The concentrators are hooked up so that they are completely interchangeable in emergencies, and are also used to help exhaust and ventilate the warehouse area in the summertime.

In keeping with the necessity of a "minimum maintenance plant" and a policy of water conservation, Superior uses a Niagara Aero heat exchanger to furnish 1500 gpm of evaporatively-cooled water for the Hygrol conditioners and other units in the plant requiring water cooling. This unit keeps all of the process cooling water in a completely closed system, thus permitting the use of treated water and eliminating time and labor consuming shut-downs for coil cleaning. The heat exchanger operates both winter and summer, furnishing temperature-controlled water to the plant without danger of freeze-up. For the greater part of the year, this unit can also furnish cooling for the Hygrol units in the printing and assembling areas, thus necessitating mechanical re-

Niagara Aero heat exchanger furnishes 1500 gpm of evaporatively-cooled water.

frigeration in the after-cooling coils of these units only on extremely warm days to bring down the dry bulb temperature in the area. This results in a further savings of compressor horsepower.

The primary aim of Superior, high production with minimum maintenance and down time, is achieved with pneumatic operation of automatic production lines. The problem of supplying a high quality of compressed air was answered by employing a 150-hp Joy compressor in conjunction with a Niagara Aero after-cooler. This has two separate cooling coil systems to cool the water required for the inter-cooler and jackets of the air compressor. It also after-cools the compressed air to the lowest possible temperature obtainable from a system without mechanical refrigeration. As all of the air lines are located within an air conditioned plant, it is imperative to use the most effective means of after-cooling to keep condensation from occurring in the compressed air lines. The principle of evaporative cooling with wet-bulb control keeps the compressed air always below the ambient atmospheric temperature. It was the only system available to perform this without refrigeration.

Since Superior has designed its manufacturing area for conditions more comfortable than most business offices, it follows that the company would impose strict standards on its new office conditioning. Here also is applied the principle of chemical dehumidification. The office area is conditioned by a Hygrol conditioner handling 13,000 cfm of air. The unit cools and dehumidifies, as well as humidifies, allowing control of the dry bulb, dew point and optimum working conditions separately. The use of this system again allows the manufacturer to save approximately 30 hp which mechanical refrigeration would have used in addition for this same application.

Department Store's Marquees Offer Cold Weather Comfort

A "warm reception" is promised customers of Saks Fifth Avenue, one of New York's leading department stores, during the chilly months of the year. The welcome luxury of summer sunshine will be provided by a unique heating-lighting system installed under the marquees at the store's Forty-ninth Street and Fiftieth Street entrances. The system went into operation with the arrival of fall's first chilly weather.

In addition to giving warmth and light, the system will benefit patrons by keeping sidewalks dry, elimi-

nating the accumulation of snow and ice, and evaporating puddles of water. In so doing it will improve pedestrian safety and create a cleaner, more inviting entrance area. Featuring General Electric's tubular quartz infrared lamps, which heat with radiant energy, the installation is the first in the nation for department store marquees.

Radiant heat striking pedestrians at a distance of five feet above the sidewalk amounts to about 90 watts per square foot, or the equivalent of the heat provided by sunlight on a warm summer day. Light produced by the lamps amounts to 750 footcandles at the same height, or about two times the amount prevailing in the best-lighted business office. The sidewalk under the marquees is believed to be the best lighted anywhere.

Twenty-four 1000-watt GE lamps are used under the roof of each marquee, 15 feet above the sidewalk. Each lamp is 13 inches long, and only three-eighths of an inch in diameter. The lamps are quite safe in that quartz tubing will not break if turned on when coated with water or even ice. The water and ice will simply evaporate.

The lamps are housed in efficient, two-lamp reflector fixtures designed for the Saks project by Luminator, Inc., of Chicago. The units are louvered, and control the light and radiant energy accurately. Forty-five-degree shielding provides visual comfort.

The "comfort" heating of people in out-of-doors and other exposed locations is a new and growing use for these rugged and versatile sources of heat and light. Typical installations find them mounted over store show windows, over spectators at a race track grandstand, over hotel entrances, near work stations in unheated factories, and at railroad waiting platforms.

Because they are so compact, having one-200th the volume of conventional heat lamps of the same wattage, they can produce intense radiant heat when placed side by side, or in layers. In this manner they are employed in the nation's space and defense programs to simulate the heating effects encountered in the flight of space vehicles, ballistic missiles, and supersonic aircraft.

The efficient heat lamps are employed in great numbers for drying and baking jobs in industry. They also are used for the thawing of railroad coal and ore cars, allowing them to be dumped in freezing weather.

Louis Blendermann on

PLUMBING and PIPING

Wall Mounted Urinal Installations

WITH emphasis on a high degree of sanitary cleanliness in the rest room, there is a current trend to install fixtures mounted on the wall above the floor. Wall mounted urinals can be placed in this category. When fixtures are set above the floor, cleaning the floor is made easier.

Types of Urinals

Although there are a number of types and styles of urinals from which to select, the basic types may be classified as illustrated in Fig. 1: integral flush urinal, flushing rim urinal, and women's urinal.

The name "integral flush urinal" has been devised for this article to define the unit shown in Fig. 1. The name has been borrowed from the integral flush spreader device that is incorporated in the urinal. Water may be supplied by an elevated flush tank, an exposed flush valve or a concealed flush valve and this applies to all three types mentioned. The urinal can be supported on one of several different devices that are available for the purpose.

The flushing rim urinal obtains its name from the manner in which the flushing action takes place in the fixture.

The women's urinal, as its name implies, is intended primarily for use by women. This type has become increasingly popular in recent years.

Although, elevated flush tanks are mentioned as a means of water supply, only the exposed and concealed flush valves will be considered and discussed in this article.

Integral Flush Urinals

Figure 2 shows a typical installation of this urinal

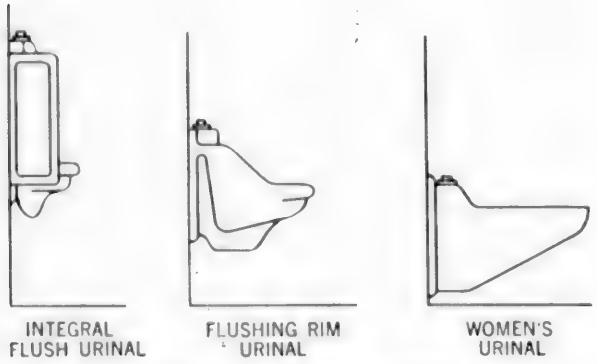


Fig. 1. Three basic types of wall mounted urinals.

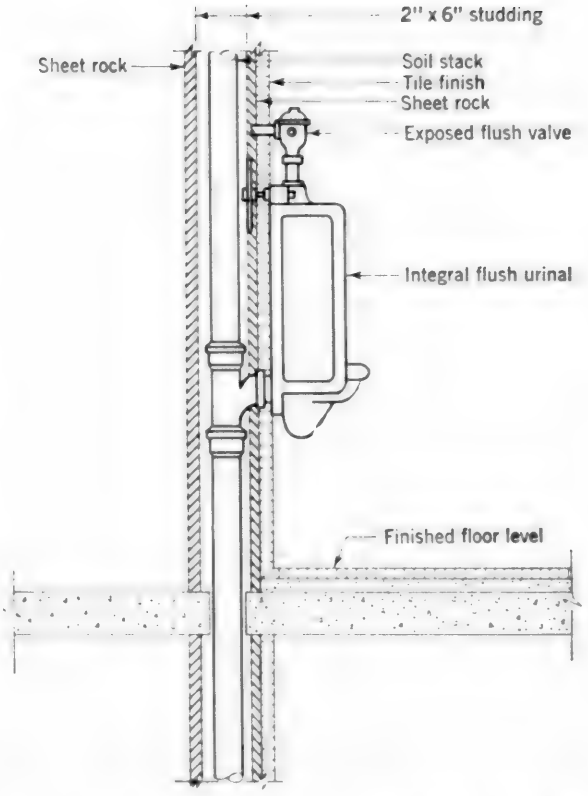


Fig. 2. Typical installation of an integral flush urinal with the roughing contained in a space of minimum dimensions.

using minimum dimensions. The construction consists of 2 x 6-inch studding faced by sheetrock and tile on one wall and sheetrock on the other wall. The waste outlet connection from the urinal in generally 2 inches. The soil stack to which the waste is connected may be 2, 3 or 4 inches as required by the local code. Cast iron hub and spigot pipe is used in all the illustrations (except Fig. 8) to indicate maximum physical dimensions for the piping. Galvanized steel, galvanized wrought iron or copper piping may be employed with equal success. The cast iron pipe is for example only.

The urinal is shown as being supported on a steel plate which is, in turn, secured to the studding. Other types of devices are also available for the support of the urinal.

Figure 2 shows the urinal installed as a single fixture in the room. If other fixtures as water closets and lavatories are installed on the same wall, the urinal

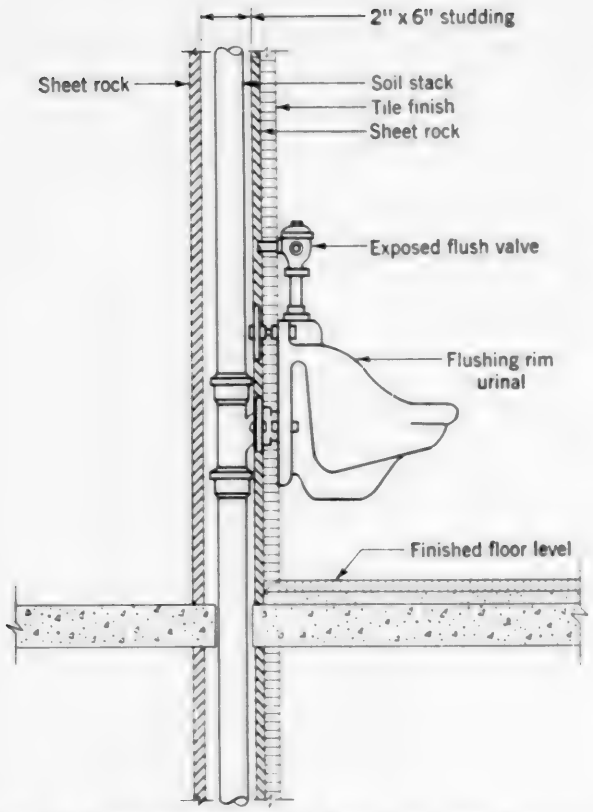


Fig. 3. Typical installation of a flushing rim urinal. Roughing is contained in a minimum pipe space.

roughing would then be component with the roughing for the other fixtures.

Flushing Rim Urinal

Figure 3 shows the flushing rim urinal mounted on the same type of stud construction described in Fig. 2. The urinal is supported on two steel carrier plates which are secured to the stud construction. Threaded rods, attached to the steel plates, extend out and engage the urinal for support. Other types of supporting devices are available.

The urinal waste outlet is 2 inches, although a 3-inch outlet may be specified. The soil stack may be 2, 3 or 4 inches as required by the urinal outlet connection or the local code. Here again, the urinal has been shown as a single installation. When other fixtures are installed on the same wall, the urinal roughing will be installed component with the roughing of the other fixtures.

Women's Urinal

Figure 4 shows how a women's urinal may be installed using minimum proportions. The construction is similar to that of Fig. 2. The urinal waste outlet and stack are 4 inches. The urinal is supported on a cast iron or steel bracket which in turn is attached to a foot that is rigidly set in the floor construction. Threaded rods extend out from the plate to engage and anchor the urinal. If other fixtures are installed on the same wall, the urinal roughing will become a part of the roughing for the other fixtures.

Battery of Integral Flush Urinals

When the integral flush type urinal is contained in a battery installation, the roughing would be similar to that shown in Detail *A* of Fig. 5.

The waste from the urinal connects with a horizontal waste line which connects with the vertical soil stack. It is the arrangement of the vertical soil stack, vent stack and cold water riser that generally prescribes the amount of pipe space that must be allotted. In this case, the pipe space is 12 inches, which may be further reduced to 10 inches, with a special arrangement of the vertical lines. The floor in the pipe space has been deleted from the drawing to clarify the illustration of the vertical lines.

The urinal is supported on a carrier assembly consisting of feet, upright piping and a plate attached to the uprights, as shown. Threaded rods extend from the plate to engage and secure the urinal in place.

Detail *B* shows how the roughing would be arranged when an access corridor is contemplated. The 24-inch pipe space offers sufficient room for the maintenance man to perform his duties.

Battery of Flushing Rim Urinals

Roughing for the flushing rim urinal is shown in Fig. 6. The 2 or 3-inch urinal connection shown in Detail *A*, ties in with the horizontal waste line which connects with the vertical soil stack. Here again, the pipe space is 12 inches, with a possible reduction to 10 inches only when a special arrangement of vertical

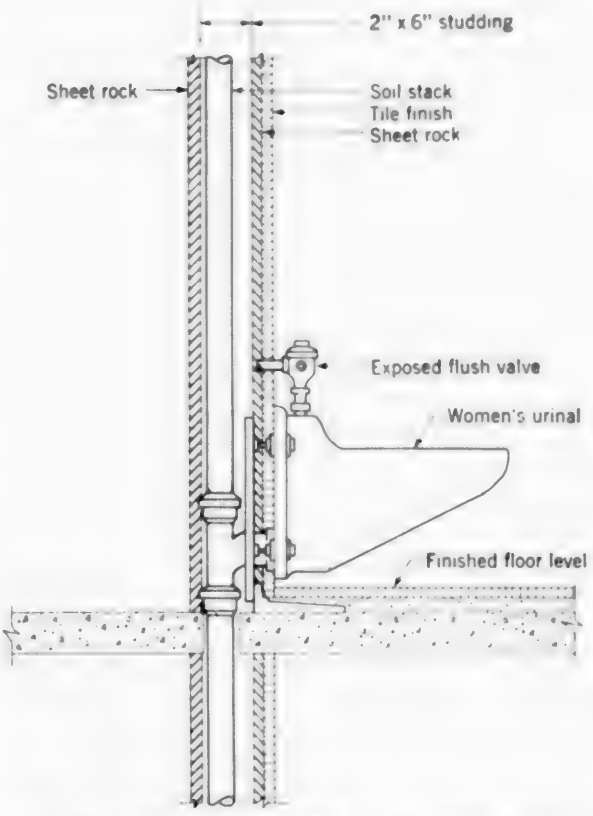


Fig. 4. Installation and roughing for a women's urinal.

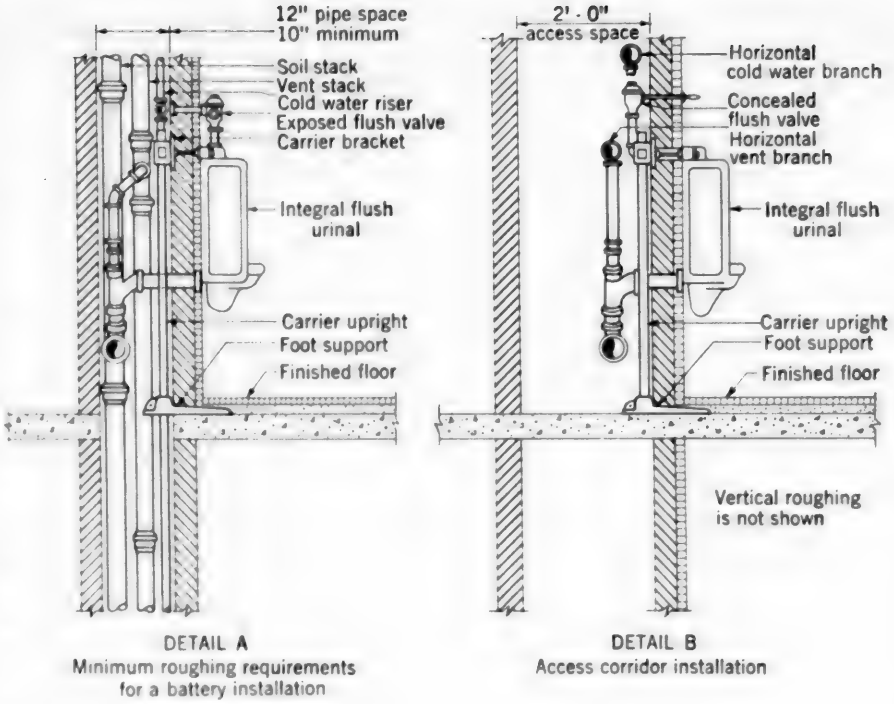


Fig. 5. Two installations for integral flush type urinals.

piping is utilized. The floor slab in the pipe space has been deleted from the drawing to clarify the arrangement of the necessary vertical piping.

The urinal is supported on a heavy cast iron carrier assembly which is held upright by a foot embedded in the floor construction. Threaded rods extend out from the assembly to engage and secure the urinal.

Detail *B* shows the typical arrangement that may be employed when an access corridor is used. The pipe space is 24 inches wide to offer freedom of movement for the maintenance man.

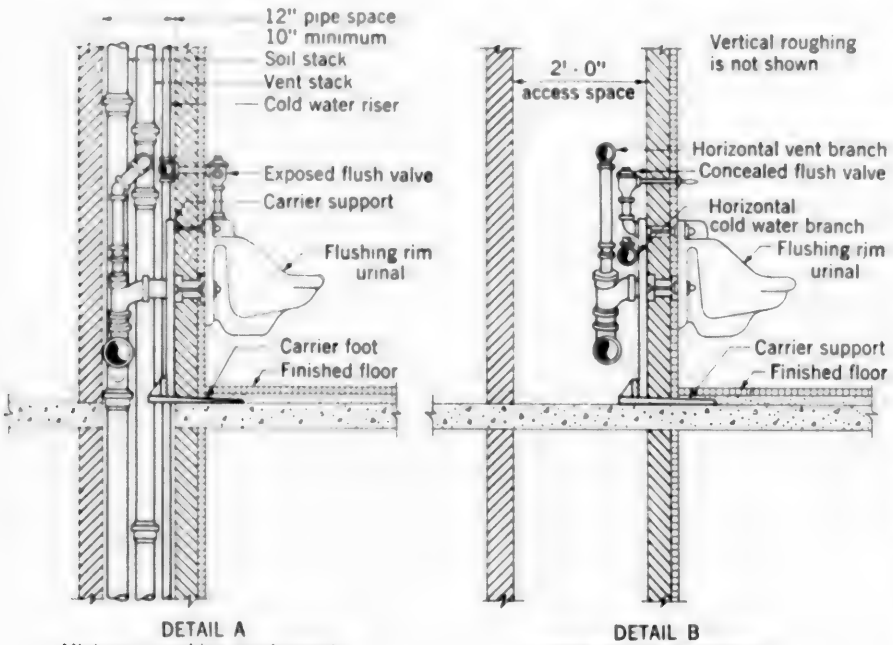
Battery of Women's Urinals

Figure 7 suggests the type arrangement that might be followed in the roughing for a women's urinal.

Detail *A* of this figure shows the carrier fitting combination that is used to support the women's urinal. This combination is comprised of an adjustable fitting, an upright support plate which is rigidly attached to a foot that is embedded in the concrete slab. Threaded rods extend out from the carrier face plate to engage the urinal and secure it in place.

The standard pipe space is 12 inches. Cast iron hub and spigot piping has been used to indicate the maximum in physical piping dimensions.

Detail *B* shows that particular arrangement of roughing that may be followed when an access corridor of 24 inches is considered. Here a concealed flush valve is used. Access corridors should be well lighted and ventilated to serve a useful function. An access corridor permits adjustments to be made to the flush valves without disturbing the occupants of the rest room.



Back to Back Urinal Installations

Back to back urinal installations were not considered in this article since it is a rare occasion that urinals are generally placed in such a manner. It might only occur in a building strictly devoted to occupancy by men. Should this condition prevail, then the minimum pipe space for the roughing would range from 15 to 18 inches dependent upon the urinal used and the particular arrangement of the roughing.

Fig. 6. Two installations for flushing rim type urinals.

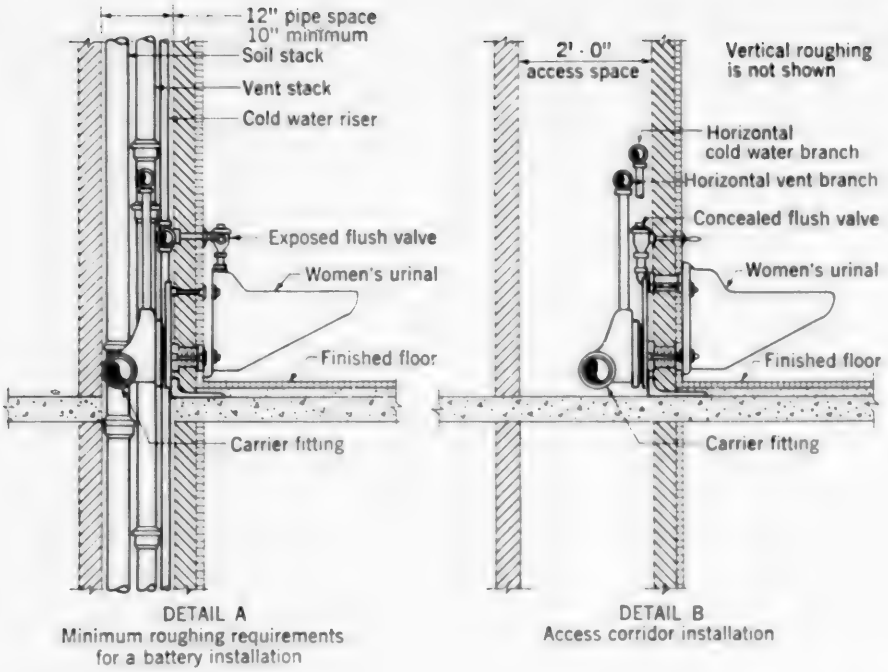


Fig. 7. Two installations for women's type urinals.

Installation of Roughing

The specific methods of roughing that may be used with the different urinals covered in this article are shown in Fig. 8.

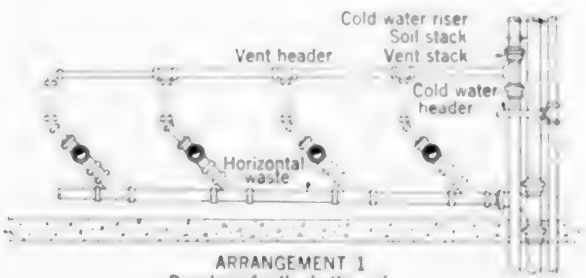
Arrangement 1 shows the typical installation of the roughing for the integral flush type urinal and the flushing rim urinal. Threaded pipe and fittings have been indicated in this case to show a variation over the hub and spigot cast iron piping used for example throughout this article. The waste piping has been placed at a 45 deg angle. Each waste connection is individually vented. Cast iron hub and spigot piping has been illustrated for the vertical piping. The engineer can use any particular arrangement of roughing which he may favor, there certainly are several different ways in which this part of the installation can be accomplished.

Arrangement 2 shows the typical roughing arrangement that might be employed for the women's urinal. Here the closet carrier combination has been used for the support of the urinals as well as to receive the discharge from the urinals. The combination fittings are adjustable in that they compensate for the pitch in the horizontal waste piping. The slot shown in the face of the fitting offers the range of adjustment needed for the pitch in the line.

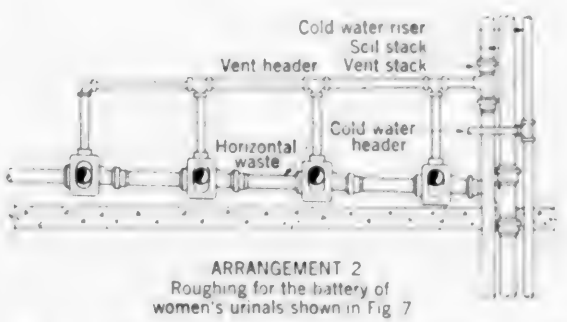
The combination fittings shown are of the caulked type although threaded type fittings are also available for the function. The foot and face plate have been deleted from the detail for clarity in showing the fitting itself. The face plate will contain the threaded rods which extend out to engage the urinal.

The vent header is of threaded piping and the vertical vents are caulked into the combination fitting. The vertical piping is of the cast iron hub and spigot type. As mentioned earlier in this article, piping materials of galvanized steel, galvanized wrought iron or copper may be used with equal success as desired by the engineer. Another arrangement of roughing other than that shown in Arrangement 2 may be used, as favored by the engineer.

The installation of the urinal and its component roughing should always be accomplished in a manner that conforms with the local code requirements of the area in which the building is to be erected.



ARRANGEMENT 1
Roughing for the battery of
urinals shown in Fig 5 and 6



ARRANGEMENT 2
Roughing for the battery of
women's urinals shown in Fig 7

Fig. 8. Two arrangements of roughing for wall mounted urinals.

Consulting Engineers Council Considers Recommendations for

Improved Engineering Practice

PROBLEMS of importance to the consulting engineer in the conduct of his business were discussed at the semi-annual meeting of the Consulting Engineers Council held at the Penn-Sheraton Hotel, Pittsburgh, Pa., November 8-12.

Considerable discussion was devoted to the Model Engineering Registration Law adopted by the National Council of State Boards of Engineering Examiners at a meeting held in Portland, Ore., August 19, 1960. In particular, section 22D of this law was the target of most of the discussors. A review of action taken by some engineering groups shows that CEC, the American Society of Civil Engineers and the American Institute of Consulting Engineers have taken specific objection to this section for it cannot apply to firms of consulting engineers without permitting conflict of interests and the possibility that it may encourage violation of recognized codes of ethics. Other objections to this section were reported.

Another version of this section was proposed by ASHRAE to enable manufacturers to provide limited engineering services.

In a communication dated August, 1960, the Professional Engineers of Oregon, a chapter of NSPE, pointed out some inconsistencies and the need for clarification of some sections.

Several questions were raised: Should an organization such as a corporation have its practice registered? Should a corporation offer its services to the public? In an engineering firm, should the majority of the officers be registered professional engineers in the state where the firm is incorporated or should they be registered in the state where the work is to be done?

It was reported that J. K. M. Pryke of Slocum and Fuller and a member of the American Institute of Consulting Engineers had developed a substitute for the very much discussed Section 22D.

The council approved a motion to notify various Boards of Registration, of the inability of CEC to accept the model engineering registration law.

Professional Qualifications

The American Institute of Architects and CEC are both concerned over the selection of architects or engineers on a price basis, since this is not considered in the best interest of the public or the professions. Both groups, therefore, prepared a resolution that the selection of engineers or architects should always be on the basis of professional qualifications and availability, and that these policies shall apply at all times in relationships between members of these two professions.

At this meeting of CEC, this joint resolution was approved.

Another resolution that was approved was one dealing with the separation of consulting engineering and contracting on publicly financed work. CEC went on record as disapproving the practice of permitting a consulting engineer on publicly financed work to have any financial interest, whether or not known to his client, in any contracting firm that may bid on work for which he is employed.

Fees

The Fee Schedule Committee presented a report on its work. It is trying to assemble all known, available fee schedules related to any branch of engineering, for services to all classes of clients. Its objective is to tabulate fee schedules and related responsibilities stipulated in the fee schedule. The committee has received fee schedules from 36 organizations.

Catalog and Data Index

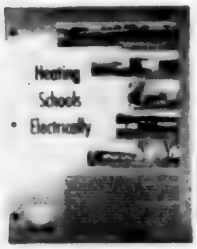
An interim report was presented by a committee concerned with a system for a catalog and data index. The ultimate goal of this work is to provide for the indexing of all advertising, catalog and technical data, using a special code reference number to facilitate filing. Since this requires the expenditure of consider-

(Concluded on page 131)

Officers of the Consulting Engineers Council are, left to right, Larry N. Spiller, executive secretary; George J. Toman, secretary; Harold P. King, first vice president; Hueston M. Smith, president; Fred Steele, second vice president; Lester L. Bosch, treasurer; Ralph M. Westcott, immediate past president.

NEW LITERATURE

Use the prepaid yellow postcard in the back of the magazine for securing your copies of these catalogs.



Heating Schools Electrically

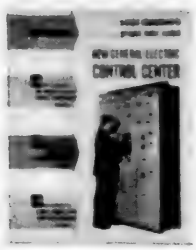
Heating schools electrically is the subject of 4-page Bulletin F00101-1, available from Edwin L. Wiegand Co., Pittsburgh, Pa. Bulletin explores advantages of electric heating, describes various installations, and breaks-down initial and operating costs for one high school.

Circle **Item 1** on Inquiry Card

Copper Pipe and Tube

A sixty-page engineering manual on copper pipe and tube products for plumbing, air conditioning and heating is available from Anaconda American Brass Co., Waterbury, Conn. Publication B-1 includes tables of water flow and friction loss, heat loss factors, dimensional data, etc.

Circle **Item 2** on Inquiry Card



Motor Control Centers

Bulletin GED-4152, available from General Electric Co., Schenectady, N. Y., is described as giving "latest significant achievements in the art of motor control centers". The 4-page bulletin discusses the forty-plus features of G.E.'s advanced-design control center.

Circle **Item 3** on Inquiry Card

Air Conditioning Equipment

Air conditioning equipment for the "big" jobs is described in 8-page Bulletin LL-349-10 by Airtemp Div., Chrysler Corp., Dayton, Ohio. Its 1961 commercial and industrial line includes packaged liquid chillers, packaged central station conditioners, and fan-coil units.

Circle **Item 4** on Inquiry Card

Electric and Electronic Controls

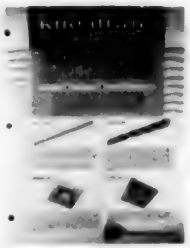
Barber-Colman Co., Rockford, Ill., announces a twenty-page Electrionic handbook which covers the application of electric and electronic controls in commercial and industrial air conditioning installations. Well-illustrated handbook explains theory and advantages of this type of control.

Circle **Item 5** on Inquiry Card

Industrial Vent Pipe

The advantages and properties of Transite industrial vent pipe, as well as engineering data for its application, are contained in 20-page Brochure TR-237A. Published by Johns-Manville Corp., New York, New York, brochure includes installation recommendations.

Circle **Item 6** on Inquiry Card



Air Diffusers

Connor Engineering Corp., Danbury, Conn., offers 4-page Bulletin 31-F which illustrates and describes representative models in the Kno-Draft lines of linear, rectangular and circular air diffusers; grilles and registers; high velocity equipment; and Dorex air purification apparatus.

Circle **Item 7** on Inquiry Card

Valve Lubricant Gun

A lightweight, portable, air-operated lubricating gun for large-scale valve lubrication is described in a 6-page bulletin by Meter and Valve Div., Rockwell Manufacturing Co., Pittsburgh, Pa. Operating instructions and maintenance recommendations are included.

Circle **Item 8** on Inquiry Card

Power Roof Ventilators

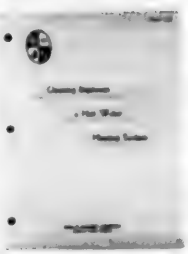
Eight-page Bulletin 2701, published by Ilg Electric Ventilating Co., Chicago, Ill., describes Type L-CRF centrifugal power roof ventilators for exhaust applications at static pressures up to 2 inches. Included are capacity ratings, noise level classifications, motor selection data.

Circle **Item 9** on Inquiry Card

Electromagnetic Drives

MagnaFlow electromagnetic drives, for conveyors, fans and pumps, and anywhere the need for speed control exists, are described in a 12-page booklet (B-7875) by Westinghouse Electric Corp., Pittsburgh, Pa. It tells how electromagnetic drives work and how they may be applied.

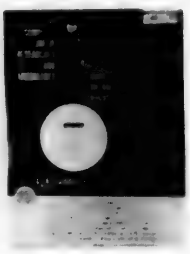
Circle **Item 10** on Inquiry Card



Hot Water Heating Systems

How cleaning improves a hot water heating system is the subject of a bulletin (Form 324) offered by Bell & Gossett Co., Morton Grove, Ill. The educational bulletin includes: How to tell if system needs cleaning; How to clean a steel or copper pipe hot water heating system.

Circle **Item 11** on Inquiry Card



Sound Control Products

Acoustical Div., Elof Hansson, Inc., New York, N. Y., announces 20-page Catalog 61 which contains a complete listing of sound absorptive, sound isolating and special purpose acoustical materials. Product descriptions include combustibility rating and method of application.

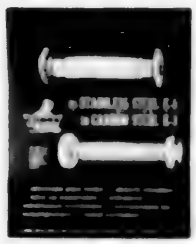
Circle **Item 12** on Inquiry Card

Use the prepaid yellow postcard in the back of the magazine for securing your copies of these catalogs.

Unit Air Filter

AAF Foamat filter, a new unit air filter employing a single sheet of synthetic plastic material, is described in 4-page Bulletin 208 by the manufacturer, American Air Filter Co., Inc., Louisville, Ky. Bulletin covers construction, operating characteristics, and performance data.

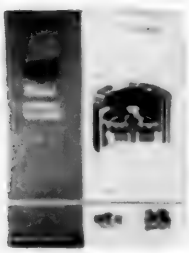
Circle **Item 13** on Inquiry Card



Flexible Metal Hose

Cobra Metal Hose, Chicago, Ill., announces publication of 8-page Catalog 539 illustrating and describing an extensive selection of flexible metal connectors in carbon steel and stainless steel. Complete specifications, including pressures and working temperatures, are included.

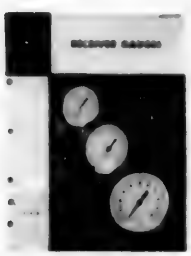
Circle **Item 14** on Inquiry Card



Automatic Check Valves

How to eliminate dangerous line surges and water hammer in any piping system is the theme of an informative bulletin on CPV Silent check valves. Published by Combination Pump Valve Co., Philadelphia, Pa., the bulletin uses photos, diagrams and graphs to explain operation.

Circle **Item 15** on Inquiry Card



Receiver Gages

Eight-page Catalog 520 describes the line of dial indicating receiver gages offered by U. S. Gauge, Div. of American Machine & Metals, Inc., Sellersville, Pa. These are special-purpose low-pressure gages used to indicate values transmitted by pneumatic signal from a remote location.

Circle **Item 16** on Inquiry Card

Packaged Condensing Units

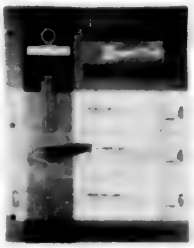
Kramer Trenton Co., Trenton, N. J., offers 4-page Bulletin C-460B which describes its line of Unicon-Compressors, completely packaged, air-cooled condensing units. Designed for cost-saving outdoor installation, these units are available in both horizontal and vertical face models.

Circle **Item 17** on Inquiry Card

Blowers

Its extensive line of Turbo blowers is described in 4-page Bulletin 300 by The North American Mfg. Co., Cleveland, Ohio. Covered are blower applications, construction, and selection of options, such as power, drive, discharge positions, accessories, and connections.

Circle **Item 18** on Inquiry Card



Tank Heaters

The complete line of Thermo-Flo tank heaters is described in 8-page Bulletin 300 by manufacturer, Brown Fintube Co., Elyria, Ohio. Three types of tank heaters are listed; applications, dimensions, heating surface and other specification data are presented for each type.

Circle **Item 19** on Inquiry Card

Seamless Welding Fittings

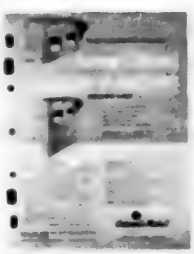
Tubular Products Div., The Babcock & Wilcox Co., Beaver Falls, Pa., announces 8-page Bulletin FB-502A on its seamless welding fittings and flanges in carbon, alloy and stainless steels. Booklet includes charts of standard sizes and schedules according to ASA B36.10 and ASA B36.19.

Circle **Item 20** on Inquiry Card

Fresh Air Electric Heating

Fresh air electric heating is the subject of a 40-page brochure published by Lennox Industries Inc., Marshalltown, Iowa. Booklet covers the requirements of good house construction, discusses methods of heating by electricity, and demonstrates desirability of ducted systems.

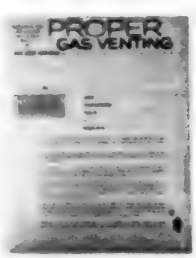
Circle **Item 21** on Inquiry Card



Central System Conditioners

A 2-page bulletin describing heavy-duty central system air conditioners, in 3 to 92 nominal ton sizes, is published by Halstead & Mitchell Co., Pittsburgh, Pa. A condensed chart gives data on capacities, air quantities, and available face areas of coils for various size models.

Circle **Item 22** on Inquiry Card



Proper Gas Venting

The second in a series of bulletins dealing with safe, modern methods of gas vent installation has been produced by Gas Vent Institute, Chicago, Ill. Bulletin No. 2 covers advantages gained by use of Type B double wall metal vents in place of Type C single wall gas vent connectors.

Circle **Item 23** on Inquiry Card

Makeup Air Units

Direct-fired makeup air units, made by National Heater Co., Inc., St. Paul, Minn., are said to provide the most efficient means possible of supplying pre-heated fresh air to replace exhausted air. Advantages of these units, specifications and dimensions are listed in 4-page bulletin.

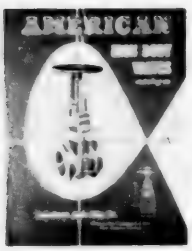
Circle **Item 24** on Inquiry Card

Use the prepaid yellow postcard in the back of the magazine for securing your copies of these catalogs.

Air Conditioning Units

Recold Corp., Los Angeles, Calif., offers 4-page Catalog 15COa describing eight sizes of smaller air conditioning units, ranging from 500 to 3000 cfm. Units are called especially adaptable to situations needing small built-up systems, to 7.5 tons. Catalog includes selection data.

Circle **Item 25** on Inquiry Card



Iron Body Valves

A 16-page catalog (No. 60) on its extensive line of iron body bronze mounted valves and accessories is available from American Valve Mfg. Co., Manhasset, L. I., N. Y. Included are gates, with screwed, flanged and hub ends, and swing checks, with screwed and flanged ends.

Circle **Item 26** on Inquiry Card

Heat Transfer Equipment

A 4-page bulletin, No. 51, describing NiaWel standard and specially-engineered heat transfer and process equipment is available from Niagara Weldments Inc., Niagara Falls, N. Y. Standard lines include storage water heaters, instantaneous heaters, and hot water converters.

Circle **Item 27** on Inquiry Card

PVC Pipe and Parts

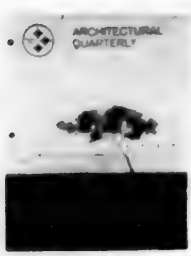
Polyvinyl chloride pipe, sheets, rods and fabricated parts available from Industrial Plastics Div., Joseph T. Ryerson & Son, Inc., Chicago, Ill., are described in 12-page Bulletin 80-3. Complete coverage is given to properties, chemical resistance, installation and fabrication.

Circle **Item 28** on Inquiry Card

Air Receivers

Air receivers for tank-mounted compressors are described and diagrammed in a 4-page bulletin published by The Kargard Co., Marinette, Wis. The company manufactures a complete line of air receiver tanks, both code and non-code, in vertical, horizontal, and portable models.

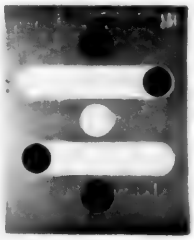
Circle **Item 29** on Inquiry Card



Stainless Steel Applications

The Fall issue of Architectural Quarterly is announced by The Committee of Stainless Steel Producers, American Iron and Steel Institute, New York, N. Y. The 8-page bulletin highlights architectural applications of stainless steel in New York City and Pittsburgh.

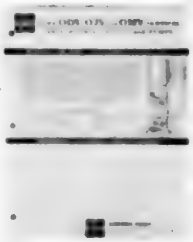
Circle **Item 30** on Inquiry Card



Piping Flexibility Analysis

A 12-page booklet that describes a computer service for piping flexibility analysis is announced by The Service Bureau Corp., (A Subsidiary of IBM), New York, N. Y. Using a simplified, do-it-yourself input feature, the service provides an analysis within 24 hours or less.

Circle **Item 31** on Inquiry Card



Vertical Centrifugal Pumps

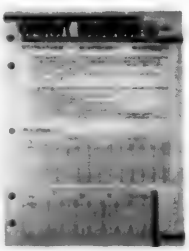
Two-page Bulletin 105-V illustrates and describes the line of vertical, single-stage, split-case centrifugal pumps recently announced by Aurora Pump Div., The New York Air Brake Co., Aurora, Ill. Capacities range to 6000 gpm and heads to 380 ft for these compact, dependable pumps.

Circle **Item 32** on Inquiry Card

Incinerator Selection

A slide-type calculator designed to simplify the selection of incinerators for various types of installations is offered by Morse Boulger, Inc., New York, N. Y. The device is a time-saver in determining not only the type but also the size incinerator recommended in each case.

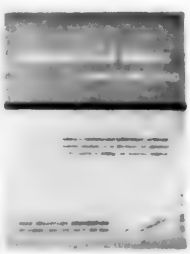
Circle **Item 33** on Inquiry Card



Insulation for Electric Heat

For the designer of electrically-heated buildings, The Dow Chemical Co., Midland, Mich., has published heat loss values for each of its plastic foam insulations: Roofmate, Styrofoam and Scorbord. Heat loss values are expressed in both "Watts" factor and "U" factor.

Circle **Item 34** on Inquiry Card



Improved Sound Barriers

A 12-page engineering report, published by Lead Industries Association, New York, N. Y., explains in detail how to calculate the effectiveness of a partition or sound barrier. The booklet covers building walls, movable office partitions, and machinery enclosures.

Circle **Item 35** on Inquiry Card

Infra-Red Heating Units

Called a low-cost heating problem solver for swimming pools, churches, offices, restaurants, bowling alleys and other applications, Infra-Mite infra-red heating units are available from Apextro Products Co., Los Angeles, Calif. Two-page bulletin gives quick-selection chart, specs.

Circle **Item 36** on Inquiry Card

DEGREE-DAYS FOR SEPTEMBER AND OCTOBER, 1960

Normal figures for September and October were omitted in this issue. Monthly normals will commence with November data in next month's issue.

(A) Airport readings; (C) City office readings; (O) Readings at a point on outskirts of city

AIR CONDITIONING, HEATING AND VENTILATING'S 33rd Year of Publication of Monthly Degree-Day Data

City	September 1960	October 1960	September 1959	October 1959	Season to Oct. 31, incl., from Sept. 1		
					1960	1959	Normal
Abilene, Texas (A)	3	55	6	118	58	126	153
Albany, New York (A)	100	480	143	423	580	566	582
Albuquerque, New Mexico (A)	3	256	20	250	259	270	228
Alpena, Michigan (C)	289	574	228	613	863	841	745
Anchorage, Alaska (A)	530	860	514	998	1390	1512	1409
Asheville, North Carolina (C)	32	194	21	204	226	225	312
Atlanta, Georgia (A)	5	84	8	121	89	129	118
Atlantic City, New Jersey (C)	16	233	39	215	249	254	259
Augusta, Georgia (A)	0	76	1	74	76	75	59
Baltimore, Maryland (C)	4	188	28	191	192	219	236
Billings, Montana (A)	150	416	251	543	566	794	691
Binghamton, New York (C)	64	467	91	318	531	409	569
Birmingham, Alabama (A)	0	99	1	99	99	100	136
Bismarck, North Dakota (A)	228	551	273	749	779	1022	825
Block Island, Rhode Island (A)	79	309	73	282	388	355	418
Boise, Idaho (A)	63	377	212	470	440	682	524
Boston, Massachusetts (A)	103	335	79	319	438	398	392
Buffalo, New York (A)	77	441	111	388	518	499	555
Burlington, Iowa (A)	45	312	82	424	357	506	419
Burlington, Vermont (A)	195	600	177	525	795	702	693
Cairo, Illinois (C)	0	143	2	196	143	198	189
Charleston, South Carolina (C)	0	35	0	28	35	28	34
Charlotte, North Carolina (A)	4	112	2	148	116	150	154
Chattanooga, Tennessee (A)	6	160	1	149	166	150	193
Cheyenne, Wyoming (A)	176	496	298	675	672	973	818
Chicago, Illinois (A)	26	301	62	406	327	468	440
Cincinnati, Ohio (C)	4	180	29	242	184	271	264
Cleveland, Ohio (A)	67	427	78	348	494	426	415
Columbia, Missouri (A)	11	213	45	319	224	364	324
Columbia, South Carolina (A)	0	85	1	98	85	99	76
Columbus, Ohio (C)	26	267	54	313	293	367	358
Concord, New Hampshire (A)	180	560	174	485	740	659	719
Concordia, Kansas (C)	28	213	85	382	241	467	332
Dallas, Texas (A)	0	45	0	73	45	73	53
Denver, Colorado (A)	90	396	191	518	486	709	545
Des Moines, Iowa (A)	82	339	131	471	421	602	454
Detroit, Michigan (A)	53	368	92	409	421	500	477
Devils Lake, North Dakota (C)	230	610	331	879	840	1210	930
Dodge City, Kansas (A)	34	215	56	364	249	420	302
Estherville, Iowa (A)	112	427	148	569	539	717	593
Duluth, Minnesota (A)	299	607	270	790	906	1101	891
El Paso, Texas (A)	0	86	0	33	86	33	70
Ely, Nevada (A)	137	574	342	580	711	922	789
Escanaba, Michigan (C)	219	529	200	620	748	820	802
Evansville, Indiana (A)	6	215	22	272	221	294	274
Fairbanks, Alaska (A)	701	1190	642	1262	1891	1904	1775
Fargo, North Dakota (A)	223	538	226	746	761	972	801
Fort Smith, Arkansas (A)	0	102	0	137	102	137	140
Fort Wayne, Indiana (A)	51	367	83	412	418	495	484
Fort Worth, Texas (A)	0	45	0	68	45	68	58
Fresno, California (A)	0	96	6	54	96	60	86
Galveston, Texas (C)	0	15	0	10	15	10	0
Grand Junction, Colorado (A)	17	338	138	386	355	524	369
Grand Rapids, Michigan (A)	90	413	109	492	503	601	606
Green Bay, Wisconsin (A)	197	187	544	642	741	829	698
Greensboro, North Carolina (A)	21	182	26	222	203	248	231
Greenville, South Carolina (A)	3	106	3	167	109	170	141
Harrisburg, Pennsylvania (A)	23	307	59	280	330	339	377
Hartford, Connecticut (A)	117	426	107	366	543	473	485
Havre, Montana (C)	208	467	310	677	675	987	675
Helena, Montana (A)	242	572	351	652	814	1003	937
Houston, Texas (C)	0	16	0	10	16	10	0
Huron, South Dakota (A)	220	505	188	656	725	844	621
Indianapolis, Indiana	28	316	54	371	344	425	385
Jackson, Mississippi (A)	0	71	0	71	71	71	69
Juneau, Alaska (A)	466	660	408	757	1126	1165	1196
Kansas City, Missouri (A)	12	148	44	289	160	333	284
Knoxville, Tennessee (A)	3	142	0	157	145	157	212
La Crosse, Wisconsin (A)	148	438	156	577	586	733	599
Lander, Wyoming (A)	164	549	297	647	713	944	876
Lewiston, Maine (O)	192	551	171	519	743	690	666

a) Data not available.
* Figures based on Airport readings.
** Figures based on City office readings.

Normal figures in this table are based on 30-year period covering 1921 to 1950, inclusive, as compiled and published by the U. S. Weather Bureau.

Figures in this table, with two exceptions, based on local weather bureau reports. Exceptions are Utica and Lewiston, figures for which are furnished through the courtesy of Coke Sales Department, Central New York Power Co., Utica, N. Y., and Norman E. Ross, Bursar, Bates College, Lewiston, Me., respectively. [Table concluded on page 100]

Degree-Days for September and October, 1960 (Concluded)

Normal figures for September and October were omitted in this issue. Monthly normals will commence with November data in next month's issue.

(A) Airport readings; (C) City office readings; (O) Readings at a point on outskirts of city

AIR CONDITIONING, HEATING AND VENTILATING's 33rd Year of Publication of Monthly Degree-Day Data

City	September 1960	October 1960	September 1959	October 1959	Season to Oct. 31, incl., from Sept. 1		
					1960	1959	Normal
Lincoln, Nebraska (C)	55	266	109	414	321	523	389
Little Rock, Arkansas (A)	0	103	0	106	103	106	120
Los Angeles, California (C)	0	22	0	2	22	2	58
Louisville, Kentucky (A)	10	240	11	241	250	252	283
Lynchburg, Virginia (A)	29	226	37	250	255	287	285
Macon, Georgia (A)	0	67	4	75	67	79	63
Madison, Wisconsin (A)	134	484	137	566	618	703	556
Marquette, Michigan (C)	243	509	204	670	752	874	779
Memphis, Tennessee (A)	0	104	0	111	104	111	143
Meridian, Mississippi (A)	0	81	0	81	81	81	90
Milwaukee, Wisconsin (A)	142	494	117	529	636	646	562
Minneapolis, Minnesota (A)	202	503	152	634	605	786	616
Moline, Illinois (A)	(a)	348	100	462	(a)	562	459
Montgomery, Alabama	0	64	0	61	64	61	69
Nashville, Tennessee (A)	0	148	0	170	148	170	176
New Haven, Connecticut (A)	103	350	69	315	453	384	456
New Orleans, Louisiana (C)	0	17	0	13	17	13	5
New York, New York (C)	20	254	40	244	274	284	302
Newark, New Jersey (A)	14	247	39	233	261	272	348
Norfolk, Virginia (A)	0	139	10	133	139	143	161
North Platte, Nebraska (A)	124	389	198	594	513	792	545
Oak Ridge, Tennessee (C)	4	165	0	153	169	153	225
Oakland, California (A)	75	140	25	62	215	87	233
Oklahoma City, Oklahoma (A)	2	96	24	206	98	230	161
Omaha, Nebraska (A)	63	282	115	433	345	548	419
Parkersburg, West Virginia (C)	14	256	44	275	270	319	328
Peoria, Illinois (A)	53	342	66	419	395	485	425
Philadelphia, Pennsylvania (C)	2	207	28	207	209	235	252
Phoenix, Arizona (A)	0	16	0	26	16	26	13
Pittsburgh, Pennsylvania (C)	18	284	56	285	302	341	354
Pittsfield, Massachusetts (A)	190	539	180	480	729	660	756
Portland, Maine (A)	211	575	181	522	786	703	714
Portland, Oregon (C)	83	250	114	234	333	348	365
Providence, Rhode Island (A)	117	382	101	354	499	455	488
Pueblo, Colorado (A)	41	330	134	477	371	611	457
Raleigh, North Carolina (A)	11	170	23	189	181	212	128
Rapid City, South Dakota (A)	154	407	260	630	561	890	693
Reading, Pennsylvania (C)	24	285	43	250	309	293	342
Red Bluff, California (A)	0	53	14	30	53	44	59
Reno, Nevada (A)	127	493	244	404	620	648	608
Richmond, Virginia (A)	24	257	36	217	281	253	243
Rochester, New York (A)	83	452	126	407	535	533	573
Roswell, New Mexico (A)	10	132	4	101	142	205	164
Sacramento, California (C)	3	52	12	48	55	60	92
St. Joseph, Missouri (A)	44	240	73	384	284	457	282
St. Louis, Missouri (C)	5	193	25	225	198	250	240
Salt Lake City, Utah (A)	16	420	170	422	436	592	469
San Antonio, Texas (A)	0	17	0	27	17	27	25
San Diego, California (A)	0	25	0	11	25	11	26
Sandusky, Ohio (C)	22	329	61	359	351	420	393
San Francisco, California (C)	169	141	73	73	310	146	228
Sault Ste. Marie, Michigan (A)	276	596	231	686	872	917	937
Savannah, Georgia (A)	0	44	0	30	44	30	38
Scranton, Pennsylvania (A)	92	446	94	372	538	466	504
Seattle, Washington (C)	146	298	167	328	444	495	463
Sheridan, Wyoming (A)	205	506	296	638	711	934	617
Shreveport, Louisiana (A)	0	41	0	61	41	61	53
Sioux City, Iowa (A)	96	336	142	516	432	658	533
Spokane, Washington (A)	153	503	311	581	656	892	713
Springfield, Illinois (A)	13	263	56	339	276	395	315
Springfield, Missouri (A)	13	179	32	300	192	332	310
Syracuse, New York (A)	83	460	115	393	543	508	513
Toledo, Ohio (A)	64	394	98	470	458	568	489
Topeka, Kansas (C)	31	216	63	375	247	438	284
Trenton, New Jersey (C)	31	285	48	254	316	302	340
Tulsa, Oklahoma (A)	0	88	14	170	88	184	170
Utica, New York (O)	55	382	91	333	437	424	612
Valentine, Nebraska (A)	179	422	235	653	601	888	606
Walla Walla, Washington (C)	41	292	126	321	333	447	401
Washington, D. C. (A)	7	212	33	213	219	246	263
Wichita, Kansas (A)	13	171	41	300	184	341	251
Williston, North Dakota (C)	209	532	312	788	741	1100	866
Winnemucca, Nevada (A)	109	518	276	469	627	745	688
Yakima, Washington (A)	145	431	207	446	576	653	596

For footnotes, see page 99.

NEWS OF EQUIPMENT AND MATERIALS

Use the convenient prepaid yellow postcard in the back of the magazine for securing more information about new equipment and materials described in this department.

Supplies Filtered Air

A roof ventilator designed to supply filtered air in sufficient quantity for most industrial applications is

announced by Western Engineering & Mfg. Co., Los Angeles, Calif.

The TSD filter unit utilizes Farr permanent air filters for the first time in this type of application, and delivers approximately 6000 cfm at only 860 rpm with standard ¾-hp motor. Filter velocity is only 300 fpm and filtration efficiency approaches 100% on all particles in the 10-20 micron range. Assembly is of low silhouette for neat roof appearance.

More Information? Circle Item 37 on Inquiry Card.

Vacuum Breaker Avoids Spillage

A vacuum breaker that will not spill water when pressure is restored is announced by Febco, Inc., Los Angeles, Calif. It is fitted with a molded polyethylene poppet and raised check valve seat to assure rapid and positive closure, the company states.

Normally open to permit unrestricted flow of water, the valve immediately seals off non-potable lines dur-

ing pressure failures and permits air to be drawn into the service line, preventing back-siphoning. When pressure is restored, the poppet instantly shuts off the air intake without spillage and reopens the line.

Two bronze models are offered: one, made to withstand 150-psi water at 150 deg F, is available in angle or globe pattern in common sizes to 2 inches; the other, for ½ and ¾-inch lines, will handle 150-psi water at 250 deg. Both are approved by Los Angeles, Chicago, Detroit, New York, and the Western Plumbing Officials' Association.

More Information? Circle Item 38 on Inquiry Card.

Adds Electric Unit Heaters to Line

Supplementing its line of steam, hot water, and gas-fired unit heaters, Modine Manufacturing Co., Racine, Wis., announces the addition of 7 electric unit heaters. Capacities range from 5 to 25 kw, with models available for 208, 240, 277 and 480 volts.

These electric unit heaters utilize the same attractively-styled casings as the steam and hot water models. The heating element consists of steel fins bonded to steel tubes encasing nichrome wires embedded in magnesium-oxide dielectric. A built-in limit control prevents overheating.

Motors are resiliently suspended from the built-in safety fan guard mounted on the rear of the casing. Units may be suspended from the ceiling or from a wall by means of an optional bracket.

More Information? Circle Item 39 on Inquiry Card.

Foam Insulating Tape

Polyurethane foam insulating tape produced by Arno Adhesive Tapes, Inc., Michigan City, Ind., has been improved to give greater protection against heat, cold shock, vibration, dust, sound, moisture and electricity.

Called Arnofoam, tape is available in three thicknesses of urethane foam backing, ⅛, ¼, and ½ inch. Backing is firmly bonded to a strong, moisture-resistant transparent backing film. It has a high-tack transparent pressure-sensitive adhesive.

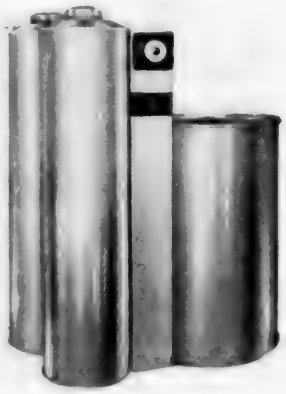
The tape has an adhesion to steel of 75 ounces per inch width and a compression strength of 1½ pounds per square inch. It has a continuous high temperature limit of 260 deg F and an intermittent limit of 300 deg. The foam also displays excellent low-temperature properties, the company states.

Used for weatherstripping, dust and moisture-proofing, soundproofing and as packaging protection against shock, heat and cold, the tape has a wide variety of applications in electronics, cooling, heating, automotive and comparable industries.

More Information? Circle Item 40 on Inquiry Card.

Large-Capacity Water Conditioner

The Miracle Water multi-bed, fully automatic water conditioning units, developed by Water Refining Co., Inc., Middletown, Ohio, utilize the company's Fast-Flo 5-cycle valve and Electro-Selector controls and are said to supply abundant softened, filtered and refined water to large gallonage users.



At water pressure of 40 psi, flow rates for commercial, institutional and light industry users are 30 to 400 gpm, depending upon the rated capacity of the unit. Modular multiple-resin-bed design permits expansion of original equipment 50% or more at a fraction of original equipment cost.

Units come from factory pre-plumbed, requiring only connection to inlet, outlet and drain lines. Photo illustrates basic MA-300 unit and indicates how mineral beds may be added to increase capacity while utilizing same controls.

More Information? Circle Item 41 on Inquiry Card.

Earth-Air Source Heat Pump

Wether-Bee, a "solar-earth" source heat pump introduced by Heat Pump Systems, Inc., Aurora, Ill., uses two heat collecting and dissipating coils, one in the earth, the other exposed to the air.

During summer, heat removed from the occupied space is rejected by the system into the ground where it is stored until it is needed during colder weather.

In winter, the pump extracts heat from the winter sunlight and stores the excess Btu's in the earth reservoir. Then, after sundown, when temperatures drop further, or on cloudy days, it utilizes the heat stored underground.

Temperature of the earth around the ground coil rises in summer when excess heat is being stored underground; in winter, this temperature drops, as surplus heat withdrawn from this underground "vault". By early spring, the system has an extremely low condensing medium available, and is prepared to utilize the winter's cold to absorb the summer's heat, the company states.

Heat pump may be installed in an upright, counterflow or horizontal position, in a crawlspace, utility room, closet or basement. One unit conditions the indoor air year-round, humidifying and warming it in winter, dehumidifying and cooling it in summer.

Pump is also manufactured as a water source unit for either water or air distribution. According to the manufacturer, this design has been tested at a coefficient of performance of 4.02.

More Information? Circle Item 42 on Inquiry Card.

Plumbing Fixtures for Schools

Bradley Washfountain Co., Milwaukee, Wis., formally introduced at the Association of School Business Officials Convention, in St. Louis, a series of products specially designed for school application. These products include stainless steel column showers, stainless steel wall hung showers, and a 36-inch semi-circular sage green washfountain.

The stainless steel column showers provide savings in material, space and installation costs because they serve as many as five students with only three plumbing connections—two supplies and one drain. Standard equipment includes shower heads, control valves, soap tray, drain casting and cover for column tap.

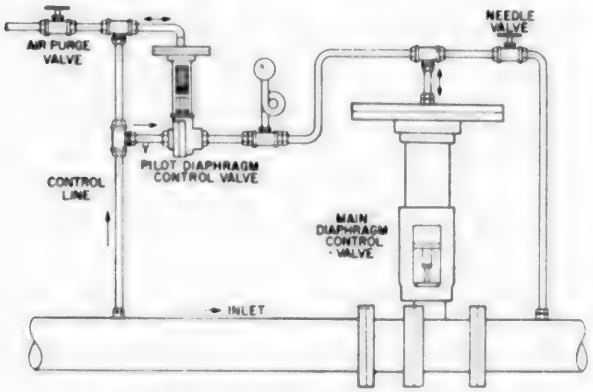
Semi-circular stainless steel wall-mounted showers, illustrated, are completely self-contained. The space saving units are available in three-student or two-student models and can be located on walls at any height desired.

Both group showers provide low-cost installation, saving as much as 80% over comparable capacity units, the company reports. Hot and cold valves for each shower head enable users to regulate water temperature independently of each other. Because the showers and receptors have no corners, maximum cleanliness and sanitation are assured while janitorial labor is reduced.

More Information? Circle Item 43 on Inquiry Card.

Back Pressure Regulators

Four- and six-inch sliding gate back pressure regulators are available from OPW-Jordan Corp., Cincinnati, Ohio. These line-operated valves have capacities



of 50,000 lb of steam per hr or 2,500 gpm of water.

Sliding gate and plates, used in both the pilot and main valve, give accurate regulation, tight shut-off and minimum maintenance, the company states. Self-lapping and self-cleaning seats are said to cut costs and provide better control over plant operations. The entire system can be purchased from the company, or just the main valve and pilot.

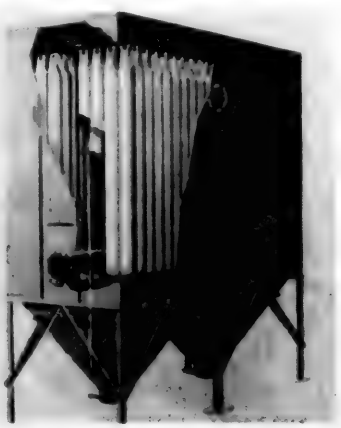
System is suitable for pressures to 250 psi wsp and temperatures to 500 deg F. Main valve is available in cast iron with 125 lb ASA flanges, or ductile iron with 150 or 300 lb ASA flanges. The pilot is a standard screwed end control valve with special seats.

More Information? Circle Item 44 on Inquiry Card.

Fabric Industrial Dust Filter

Its Fabric Filter, described as a highly efficient device for collecting industrial dusts, was added to the line of Air Pollution Control Division of John Wood Co., Bernardsville, N.Y.

Filter is available in two size ranges, the fabric envelope type for low gas volume applications, and a



tubular type for dust collection of high gas volumes. The envelopes and tubes come in a broad range of fabrics including Orlon, nylon, Dacron, and glass. The fabric is cleaned by a shaker mechanism or by reverse gas flow.

In addition to standard units, the company designs specific Fabric Filters for individual plant requirements. The company also offers a complete engineering service and is equipped to furnish turnkey air pollution control installations. The company's other pollution control devices are Yerzley scrubbers and Cyclone collectors.

More Information? Circle Item 45 on Inquiry Card.

In Winter, a Recirculator

Model ER dual exhauster-recirculator, offered by Genie-Air Products, Los Angeles, Calif., a division of N.T.W. Corporation, is an orthodox industrial exhaust ventilator in summer. In winter, however, it becomes a recirculator.

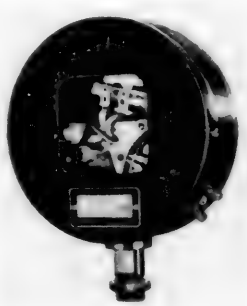
By trapping heat under the roof line in winter and recirculating it, fuel costs and initial heating equipment costs are said to be reduced as much as 50%, the company states. Positioning of a selective control switch actuates the unit's Divertco-Damper which converts the unit to either exhaust or recirculation duty.

Sizes in this model range from 3,000 to 23,000 cfm.

More Information? Circle Item 46 on Inquiry Card.

5,000-Psi Pressure Control

Added to its Series *D* pressure controls by The Mercoid Corp., Chicago, Ill., is a control operating within the range from 500 to 5000 psi. It is available in three models: Type DXA-21, minimum operating differential 450 psi; Type DXA-521, minimum differential 200 psi; and Type DXS, minimum differential 150 psi. Power element is a welded steel Bourdon tube. The control incorporates a ½-inch IPS bottom connection which is equipped with a special sealing nut having a Teflon insert, thus assuring leak-proof connection.



More Information? Circle Item 47 on Inquiry Card.

"Heat Tool" Bonds Plastic Pipe

Development of a small, hand-portable "heat tool" to bond solvent-resistant thermoplastic pipe and fittings is announced by Tube Turns Plastics, Inc., Louisville, Ky.

According to the company, the new unit, named Thermo-Seal, is a significant breakthrough in the joining of materials such as Penton chlorinated polyether, polypropylene and polyethylene in the form of

industrial piping. Perfection of this method of joining obviates past difficulties in joining these materials by solvent cementing or threading.

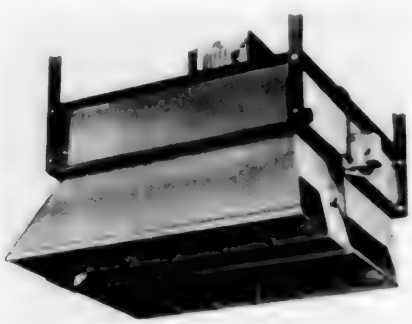
The method involves homogeneous inter-face thermal fusing of pipe and socket-type fittings. A permanently leakproof bond is made in a matter of seconds and is ready for pressurization almost instantly, the company reports.

As illustrated, the Thermo-Seal tool is an aluminum assembly with a cast-in tubular electric heater element and two surfaces upon which pipe ends and fitting sockets are heated simultaneously to fusing temperatures. The entire bore of each fitting socket and the mating surface of the pipe end are thus heated, after which the parts are removed and joined, cooling to a permanent bond in about ten seconds.

More Information? Circle Item 48 on Inquiry Card.

Dual-Purpose Door Heaters

Heaters which stop cold drafts through plant shipping doors when they are open, and supplement the plant heating system when doors are closed, have been developed by L. J. Wing Mfg. Co., Linden, N. J. The Wing Vari-Jet door heater automatically provides a



high-velocity curtain of warm air when a door opens, to penetrate and temper inrushing cold outside air. When the door closes, a damper is automatically repositioned for discharge of warm air at normal velocity, to provide either room or perimeter heating under room thermostat control. In summer, the fan may be operated without heat to promote air circulation, the company states.

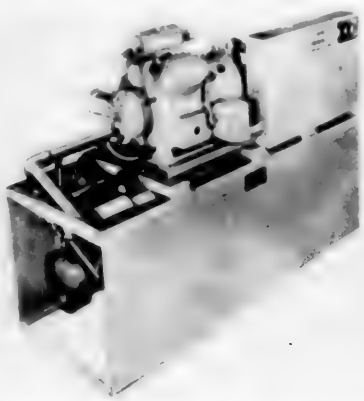
Heaters are available in ten sizes for mounting heights to 22 ft and floor area coverage up to 60 x 132 ft mounted for room heating, or 33 x 180 ft mounted for perimeter heating. Steam or hot water may be used as the heating medium.

More Information? Circle Item 49 on Inquiry Card.

Compact Liquid Chillers

A line of hermetic packaged liquid chillers for air conditioning or industrial cooling applications is now available from American-Standard Industrial Division, Detroit 32, Mich.

Designated the Versare line, chillers, designed with emphasis on versatility, compactness, ease of servicing and safety, are available in eleven models for net rated capacities up to 67.1 tons. Units are also available with or without condenser and accessories for use on



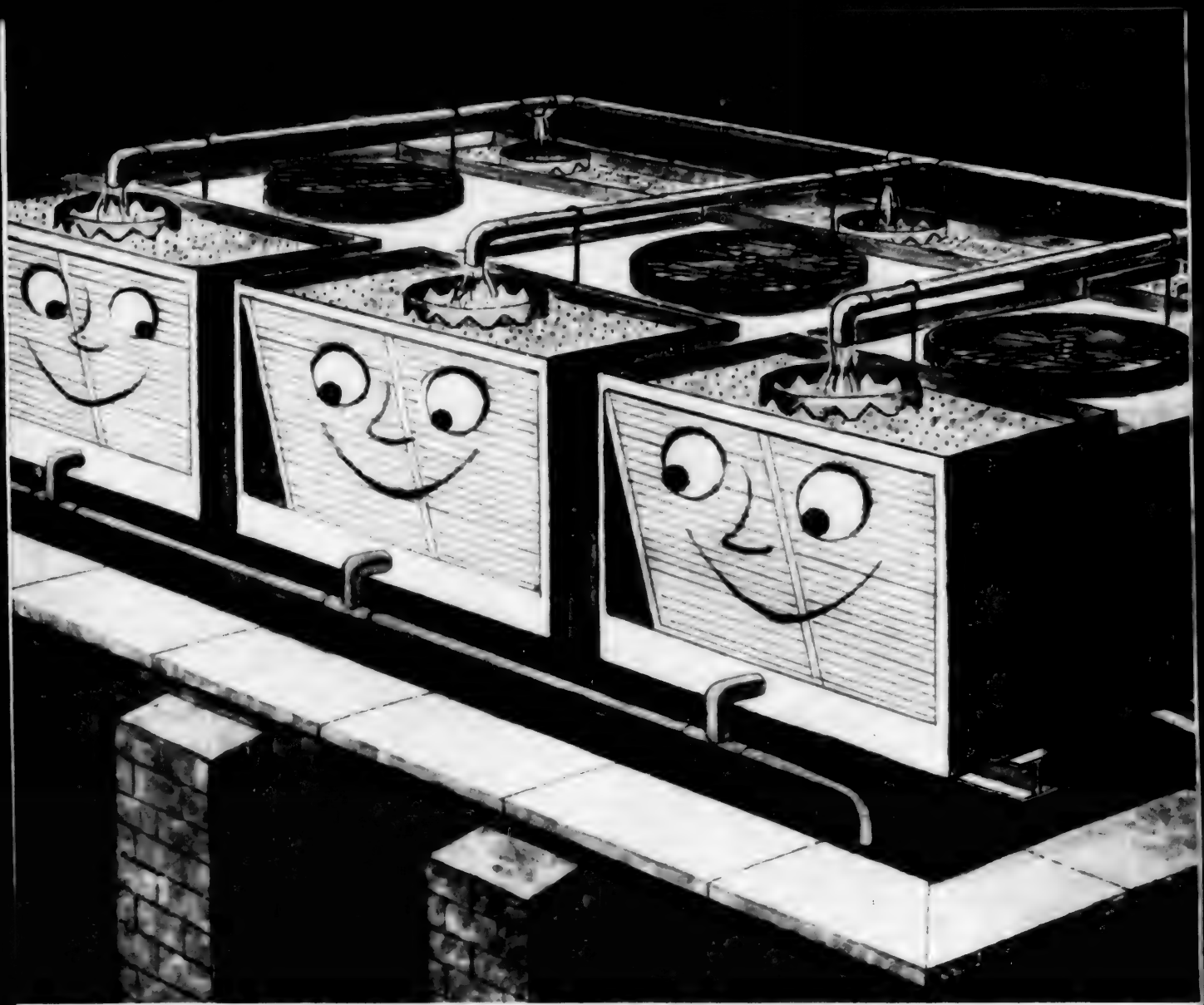
remote condenser applications. Small capacity increments meet the requirements of every installation. Minimum water piping and electrical connections have to be made in the field. Units pass through a 36-inch doorway.

Hermetic compressor construction eliminates problems associated with field alignment of compressor and electric motor drive.

Safety is a keynote of design, with automatic safety switches provided for motor overload, high motor temperature, low oil pressure, high condenser pressure or low cooler pressure. Standard control panel includes an indicator system that facilitates normal operating or trouble-shooting procedures. Pilot lights indicate normal unit operation and immediately identify shutdown causes. A cooler evacuation circuit and crankcase heaters combine to prevent large quantities of refrigerant from accumulating in the cooler or crankcase during inoperative periods, thus eliminating start-up problems.

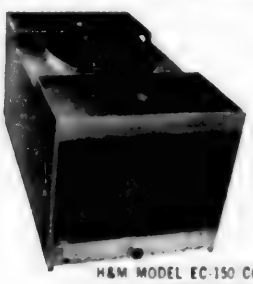
More Information? Circle Item 50 on Inquiry Card.

(Continued on page 106)



How to cut costs on a 450-ton cooling job:

Use three Halstead & Mitchell 150-ton cooling towers!



H&M MODEL EC-150 COOLING TOWER
WITH 10 GAUGE STEEL CABINET

How can three units be cheaper than one? Simple. Halstead & Mitchell packaged cooling towers come to you completely assembled and therefore less expensive to install. They operate at lower cost because there can be no wasted capacity; with step-control, you get capacity as you need it.

Furthermore, with "modular" units, you can place each tower near the equipment it's to be used with. This gives you closer control of water temperatures—another economy factor. Then, too, if one tower must be shut down, you can continue to operate the others.

The advantages go on and on: lower silhouette, lower rigging costs, and utmost flexibility—towers can be easily moved or supplemented as requirements change. And, like all H&M towers, these carry the exclusive 20-Year Guarantee on the wetted deck against failure due to fungus attack or rotting.

Contact your Halstead & Mitchell distributor for complete information on H&M cooling towers in 3- to 150-ton capacities. Or write Halstead & Mitchell Co., Bessemer Bldg., Pittsburgh 22, Pa.

HM

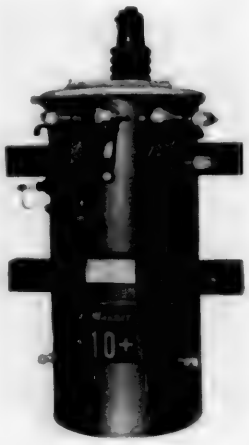
Halstead & Mitchell

Cooling Towers • Water-Cooled Condensers • Air-Cooled Condensers • Finned Coil Products • Air-Handlers

(Continued from page 104)

Separate Fire Pump Circuit

A number of special rural-line distribution transformers incorporating separate 240-volt circuits for operating well pumps were recently built by Wagner Electric Corp., St. Louis, Mo. In case of fire, if it becomes necessary to open the secondary circuit breaker of the transformer to disconnect the feeders to the house and barns, the pump circuit remains energized so that water for fighting the fire remains available.

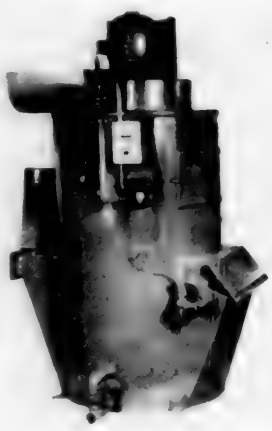


Units are conventional 10 kva 7200 to 240 volt core and coil assemblies protected by secondary circuit breakers with external operating handles. Service to the house, barns, and other buildings is supplied through the breaker, and can be cut off if necessary. The separate 240-volt circuit for the pump, which remains operative as long as the power supply to the transformer is not interrupted, is taken off ahead of the breaker.

More Information? Circle Item 51 on Inquiry Card.

Wet Type Dust Collector

A wet type dust collector, without moving parts, requiring minimum floor space, and providing maximum efficiency in cleaning air streams is announced by The DeVilbiss Co., Toledo, Ohio.



A product of the company's Metal Fabricators Division, the Uni-Wash Dust Collector is made up of standard elements which can adapt to most installations offering flexibility while retaining the cost advantages of standardization.

A complete and compact unit, particularly adaptable to metal grinding and finishing operations, collector will remove, dirt, dust, grindings, chips, fumes and vapors. No pumps or agitators are used in the air-washing process. Instead, it employs a principle for washing, scrubbing and fogging contaminants out of the air stream and depositing them as a wet sludge for manual or automatic removal. Design is said to enable the collector to be offered at a low initial cost, to assure low operating costs and minimum maintenance.

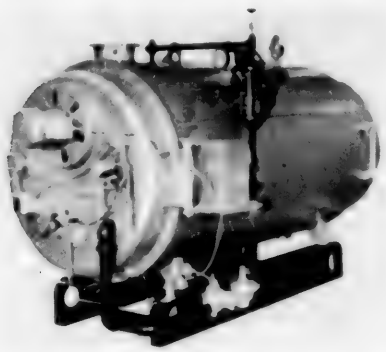
No other wet type dust collector of similar capacity requires so little floor space, the company states. With several models available, most applications can be serviced by assembling standard elements. Custom units will be manufactured by the division for unusual requirements.

More Information? Circle Item 52 on Inquiry Card.

Small Process Steam Boilers

Space-saving Monitor packaged boilers for small high pressure steam applications, such as dairies, canneries, and food processing plants, are introduced by Cleaver-Brooks Co., Milwaukee, Wis.

These four-pass horizontal fire tube type boilers,



with 5 sq ft of heating surface for each rated horsepower, are shipped ready for installation, complete with integrated boiler, burner, controls, and other components. A simple roof vent exhausts spent combustion gases.

Boilers come in sizes from 15 to 60 hp, 150 psi, and are fired with either oil or gas, with many sizes available with combination oil-gas firing. Units are field started by the company.

More Information? Circle Item 53 on Inquiry Card.

Smoke Recorder

A smoke recorder, available from Photomation, Inc., Bergenfield, N. J., is a null-balance potentiometer with rapid traverse and adjustable sensitivity that may be set to cover a desired range of a smoke spectrum. If complete coverage from clear to blackout is desired, this covers the entire chart graduated from 0-100.

Also available are charts graduated from 0-100 with Ringelmann numbers. If it is desired to read more accurately the good combustion hazes, optimum haze may be set at *50* on chart and desired limits on either side.

Recorders may be installed on new boilers and when modernizing older ones.

More Information? Circle Item 54 on Inquiry Card.

(Continued on page 108)

Now . . . pull the fan wheel or motor while DeBothezat® Bifurcator® Fan remains in duct.

Not just an access door. Half the entire cone comes off.

Speed up inspection . . . slash maintenance and downtime costs.

This removable cone design is an exclusive feature found only on DeBothezat Bifurcator Fans.

Published ratings on DeBothezat Fans tell you exactly what the complete fan unit puts out. No guess work — no allowance to be on safe side!

New design duct fan

De Bothezat® FANS

DIVISION OF

American Machine and Metals, Inc.

EAST MOLINE, ILLINOIS

THIS COUPON ANSWERED WITHIN 24 HOURS

DeBOTHEZAT FANS DIVISION, Dept. ACH- 1260
American Machine and Metals, Inc.
East Moline, Illinois

Gentlemen: Your new Removable Cone feature for DeBothezat Bifurcator Fans looks good to me. Please rush descriptive literature at once.

NAME _____

FIRM NAME _____

ADDRESS _____

CITY & ZONE _____ STATE _____

Divisions of American Machine and Metals, Inc.

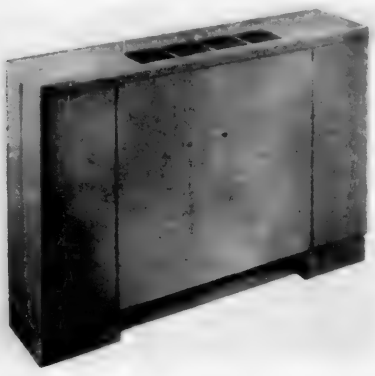
TROY LAUNDRY MACHINERY • REHLE TESTING MACHINES • DE BOTHEZAT FANS • TOLHURST CENTRIFUGALS • FILTRATION ENGINEERS FILTRATION FABRICS
NIAGARA FILTERS • UNITED STATES GAUGE • RAHM INSTRUMENTS • LAMB ELECTRIC COMPANY • HUNTER SPRING COMPANY • GLASER STEERS CORPORATION

(Continued from page 106)

Room Conditioners

A new Bohn-Aire series of remote individual room conditioners, announced by Danville Div., Bohn Aluminum & Brass Corp., Danville, Ill., is said to adapt to a wide variety of installation requirements.

Four units in five sizes each, from 200 to 600 cfm,



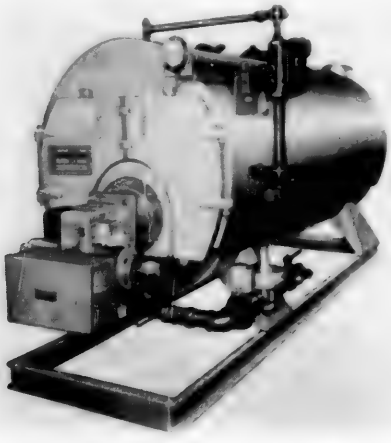
provide individual room control of temperature and humidity in apartments, motels, hotels, offices, hospitals, or any building with central hydronic cooling and heating systems.

Both concealed and cabinet models are only 8½ inches in width. Installation and service are facilitated by easily accessible mounting brackets, piping and electrical lines, and air vents; and removable filters and motor-fan assemblies. Three-speed manual control is provided.

More Information? Circle Item 55 on Inquiry Card.

Ten Scotch Marine Generators

Ten Petro-Pac Series 300 Scotch marine package generators, designed for easier maintenance, lower operating costs, and longer life, are available from Petro, Cleveland, Ohio. Ranging in capacity from 20 to 100 hp, they are designed for high or low pressure



steam or hot water for a wide variety of applications.

Generators operate on positive furnace pressure, said to be matched precisely to a forced draft burner, resulting in efficiencies well over 80% without turbulators. They can be fired with light oil or gas, or by gas-light oil combination.

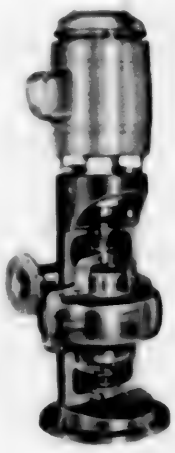
Separate head for each pass of tubes eliminates undue thermal expansion and contraction. All tubes are rolled and beaded, not welded, for less costly replacement in the field. Tubes are quickly accessible through hinged front doors. Entire boiler has steel jacketed insulation.

Water return blending device, to distribute water circulation and reduce thermal stress, is standard. Integral steam separators ensure dry steam under adverse conditions.

More Information? Circle Item 56 on Inquiry Card.

Split Case Centrifugal Pumps

Space requirements are said to have been reduced to a minimum in Type AJ two-stage split case pumps introduced by Aurora Pump Div., The New York Air Brake Co., Aurora, Ill. All the time-proven performance features of the company's horizontal split case pumps have been retained, the company states.



Developed especially for accommodation to the exacting space requirements of marine service, these pumps are well suited for use on municipal and industrial water services, pressure booster service, cooling towers, fuel service, circulation, and boiler feed. Capacities range to 1400 gpm, heads to 425 ft.

More Information? Circle Item 57 on Inquiry Card.

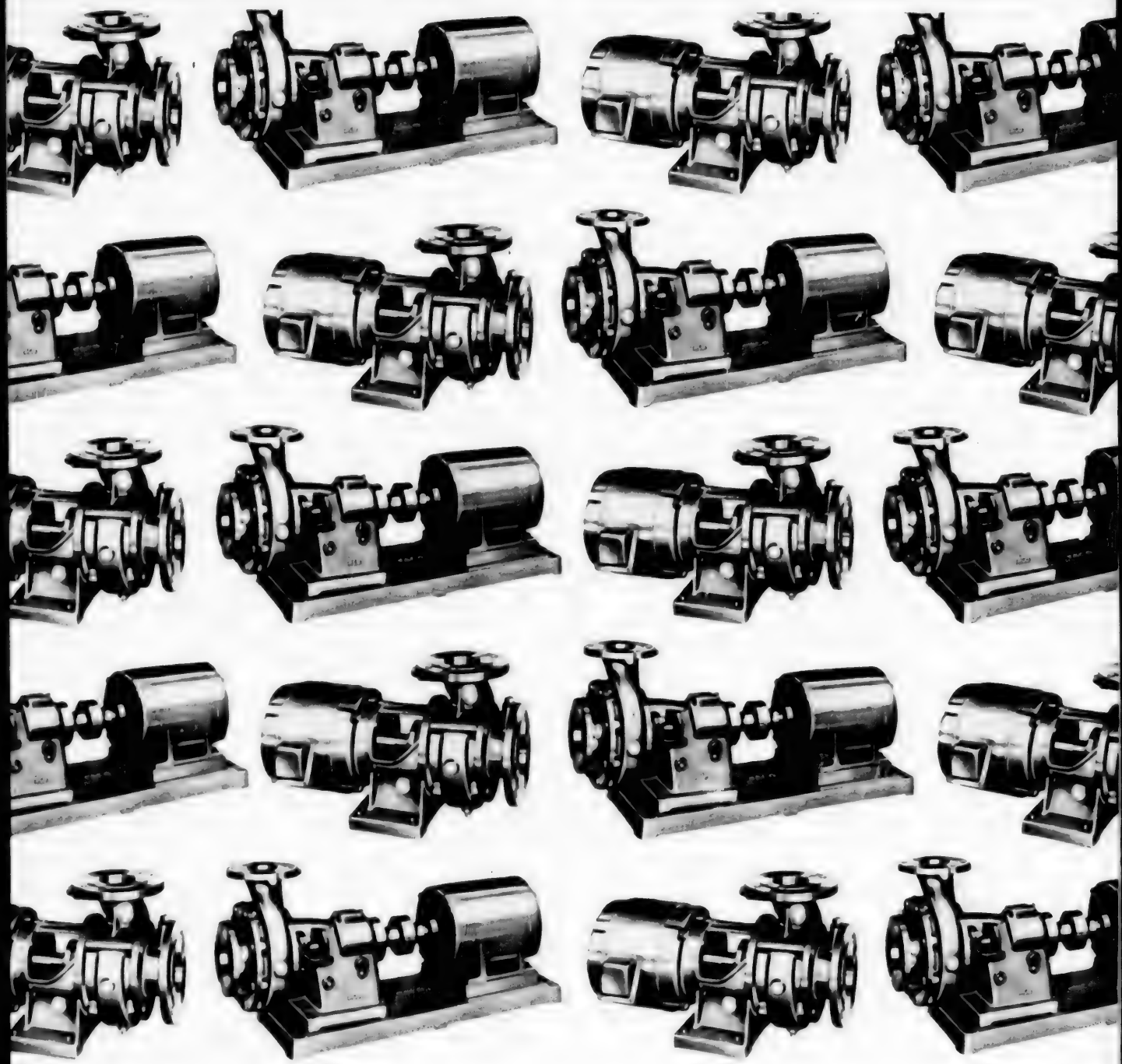
Boiler Air-Fuel Interlock

Cat. 114P static pressure control is designed by The Henry G. Dietz Co., Inc., Long Island City, N. Y., for use as an air-fuel interlock switch on packaged steam generators requiring safeguards to prevent flow of fuel when a hazardous condition is present due to lack of forced draft. Switch contacts are usually wired in series with solenoid of oil shut-off valve. Thus, oil valve prevents flow of fuel unless blowers are supplying proper forced draft.

Control is approved and listed by Underwriters' Laboratories, Inc.; Factory Mutual; and Canadian Standards Association.

More Information? Circle Item 58 on Inquiry Card.

(Continued on page 110)



TACO Stocks your Custom-Built Pumps!

That's right. By specifying any *standard* TACO "LP" pump, with its many options, you can actually order a custom-designed, single stage centrifugal pump to precisely meet your requirements!

For Hospital applications, for example, specify any standard "LP" with sleeve bearings and quiet motor. For industrial applications merely specify the *same* "LP" with ball bearings and a regular motor.

And, just as easily, you can specify an "LP", base-mounted or close-coupled . . . with mechanical seals or stuffing boxes, with or without cooling jackets . . . shafts or shaft sleeves in stainless steel and so on. What's more, every "LP" provides many extras, such as advanced design throttle bushing, oil slinger ring lubrication, center-line discharge and many more. Get complete specifications . . . specify "LP". All products in the broad TACO line are "efficiency engineered" to provide maximum performance and economy on all your installations. Write TACO HEATERS, INCORPORATED, 1160 Cranston Street, Cranston 9, R. I.

TACO

SERVING THE HYDRONIC INDUSTRY SINCE 1920

(Continued from page 108)

Plastic Pipe-Line Strainers

Polypropylene strainers to trap particles which would be injurious to process equipment are available from Vanton Pump & Equipment Corp., Hillside, N. J.

Light weight, high strength, and chemical resistance make strainers well suited for applications involving solvents, greases, oil, and the majority of common acids at temperatures to 185 deg F. Element easily removed for cleaning.

More Information? Circle Item 59 on Inquiry Card.

Grab Bar with Sixteen Sides

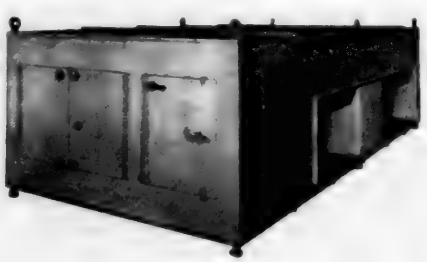
A functionally designed grab bar with a new gripping surface of sixteen flat planes is offered by the Logan Hospital Equipment Co., Glendale, Calif. For installation in showers, bath rooms, toilets and next to sitz baths or wherever self-assistance is required to aid the user, Polygrab hospital type grab bars are especially designed for the aged or handicapped in geriatrics, therapy centers, rest homes, hospitals for the mentally ill, schools or prisons. A specific type is offered for every requirement.

More Information? Circle Item 60 on Inquiry Card.

Packaged Makeup Air Heater

National Champion MA direct fired makeup air heater, manufactured by National Heater Co., Inc., St. Paul, Minn., requires no ductwork and operates independently of present heating systems, making it simple and inexpensive to install.

Designed for all makeup air requirements, including tempering, drying, and humidity control, unit has



weatherproof construction, 100% available operating efficiency, complete flexibility of installation and discharge arrangements, full modulating air flow mixer, and built-in electrical control panel.

DWDI wheels contribute to quiet operation with no flame vortexing, regardless of static pressure changes within the building, the company states.

Air is tempered by passing directly through the flame. However, according to the manufacturer the design efficiency of the unit is such that, under the most adverse conditions, air is twenty times purer than required by the Bureau of Standards and American Conference of Governmental Hygienists.

Available in twenty-six sizes from 8,000 to 150,000 cfm, units have full modulating turn-down ratio of 25:1.

More Information? Circle Item 61 on Inquiry Card.

Valve Controls Fuel Oil

A line of Mod-U-Flo control valves automatically govern flow of fuel oil to variable-fire nozzles. Developed by Hill Machine Co., Rockford, Ill., valves are made in three sizes, covering nozzle ratings of 5 to 60 gph. They will deliver straight-line variation of nozzle

output, and thus provide efficient firing of the burner down to ¼ or 1/5 of nozzle rating, the company states.

Valve, of the spool type, can be adjusted by any straight-line actuator linked to the stem which has a total linear motion of 2 inches. The spool cylinder has a spiral groove of increasing depth which meters the flow depending on what point along this graduated groove is exposed at the intake. A plastic-seat valve at the end of the spool travel provides positive shut-off.

More Information? Circle Item 62 on Inquiry Card.

Toilet Enclosure Hinge

A hinge for toilet enclosure doors that its manufacturer says will never wear out is produced by Fiat Metal Mfg. Co., Franklin Park, Ill. Bearing surface of the only working part is DuPont Zytel Nylon which is self-lubricating, and unaffected by fungus, insects, soaps, detergents, alkalies, lubricating oils and most acids.

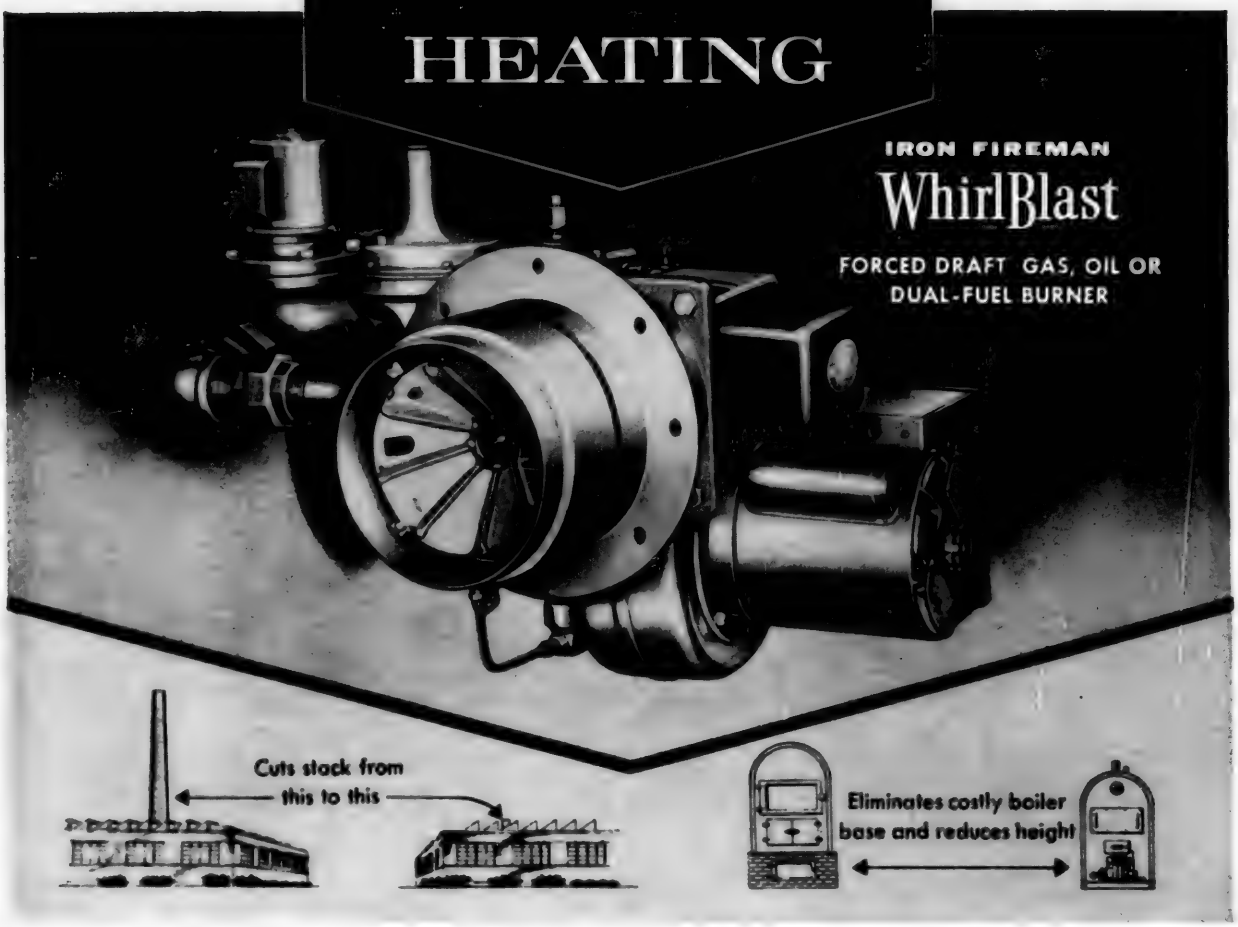
This gravity type hinge has load bearing and cam action surfaces of nylon. With its stainless steel pintle, operation is quiet and smooth. And, because Zytel Nylon is virtually frictionless, the hinge requires minimum rise and fall for accurate operation. This hinge is factory installed (except for bracket and pintle) to insure positive alignment.

More Information? Circle Item 63 on Inquiry Card.

(Continued on page 112)

The new world of

HEATING



SAVES CONSTRUCTION COSTS

No stack — no pit — no brick, inside or out. In a sealed firebox only a smoke vent is required. No high stack, no bulky draft inducer, no secondary air dampers or ducts, no brick setting, no boiler refractory. Burner fits any boiler; it simply bolts to the boiler front, with firing head through the fire door opening.

NO FLAME PULSATION

Steadiest flame ever developed. The WhirlBlast firing head, a new design, solves the persistent problem of flame pulsation. A steady, efficient, fuel-saving flame is achieved without firebox breather vents or any other makeshift device. Fires gas or oil with high efficiency; changes fuels instantly.

CLEAN

No smoke; burns clean. Accepted standards of oil firing allow a 15 minute warm-up period, during which time smoke is tolerated. The Iron Fireman WhirlBlast burner produces a clean flame in seconds, preventing fuel waste, fouled flues and air pollution.

PACKAGED

No special skill to install, adjust, service or operate When you bolt the WhirlBlast unit to the boiler front you install a complete forced draft firing system, combining air and fuel systems and electronic combustion controls. It leaves the factory as an operating unit, factory wired and tested.

Send coupon for further information

IRON FIREMAN

HEATING AND AIR CONDITIONING
AIRCRAFT COMPONENTS AND EQUIPMENT
MISSILE AND AIRCRAFT GYROSCOPES
ELECTRONIC EQUIPMENT
CONTROL INSTRUMENTS

Iron Fireman Mfg. Co., 3092 W. 106th St., Cleveland 11, Ohio.
(In Canada, 80 Ward St., Toronto)

Please send full information and specifications on the WhirlBlast Burner.

Name _____

Firm _____

Address _____

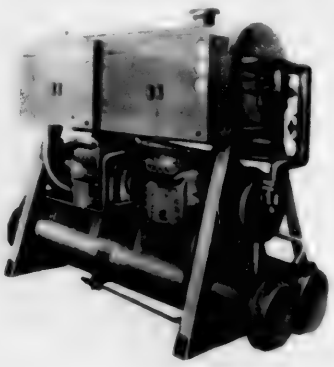
City _____ State or Prov. _____

(Continued from page 110)

Packaged Water Chillers

A new line of packaged water chillers for industrial and commercial air conditioning installations is introduced by Air Conditioning Div., Westinghouse Electric Corp., Staunton, Va. The PKB line of water chillers includes eight sizes in ratings from 20 to 100 tons.

The compressor motors on these chillers are protected by a Guardistor over-temperature control circuit that provides positive motor protection against over-



heating from any cause: excessively high or low voltage, single phasing, or loss of Freon from the compressor. In addition, quick trip overload heaters are included for positive six-second kick out on any overload condition, even on cold start.

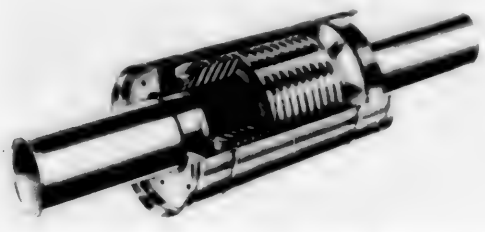
The larger units, rated at 60, 80, and 100 tons, have twin compressors that provide step starting, demand charge savings during mild seasons, and protection against complete loss of service in event of failure in one system.

Each unit is compact and complete with a wired control center that includes starters and safety operating controls. For process cooling and special commercial installations, 40-degree leaving water temperature designs are available.

More Information? Circle Item 64 on Inquiry Card.

Expansion Joints

New expansion joints for hot water and steam heating installations, for straight baseboard runs of 25 ft or more and water temperatures ranging from 100 to



250 deg F, are available from Modine Manufacturing Co., Racine, Wis.

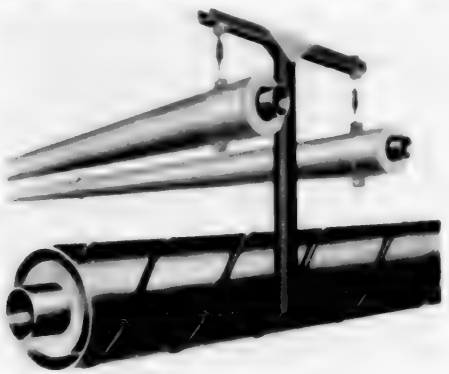
The joints have a large bronze bellows with copper tubing that is electronically welded at each end for sweat connections. Two large-sized laminated fiber rings are provided to assure a completely water-tight unit. Recommended maximum pressure for hot water is 45 psi, and for steam, 15 psi.

More Information? Circle Item 65 on Inquiry Card.

Prefabricated Piping Systems

Prefabricated piping systems for overhead and underground distribution of steam, hot water, process liquids, and refrigeration lines, called Plasti-clad, are offered by Ric-wiL, Inc., Barberton, Ohio.

Overhead system consists of pipe and insulation



covered with aluminum foil over which are two wrappings of fiber glass cloth integrated with the Plasti-clad material. A final color coat (green is standard) of Plasti-clad is applied to finish the unit.

Entire system is factory prefabricated, complete with expansion loops, anchor units, elbows, and *T* units, ready for installation.

For underground distribution, pipe and insulation are covered by a spiral welded metal conduit, which is protected against soil and stray current corrosion by a 20 to 25 mil coating of cold-cured epoxy coating reinforced with fiber glass cloth.

More Information? Circle Item 66 on Inquiry Card.

Epoxy-Clad Solenoids

Completely waterproof epoxy-clad coils, said to eliminate the most common cause of coil failure, are standard on all solenoid valves cataloged by Jackes-Evans Mfg. Co., St. Louis, Mo. Units are line tested at 2300 volts.

Most common application of these solenoids will be in fan-coil units, the company states, although they will be useful wherever it is desired to eliminate possibility of coil failure or burnout due to condensation, frost, oil, gasoline, fluid spray, or other corrosive liquids, gases and vapors.

A wide range of types is offered.

More Information? Circle Item 67 on Inquiry Card.

(Continued on page 114)

Scottish Rite Temple, Washington, D. C. Comfortably cooled at low cost with gas-operated Ready-Power Air Conditioning.
Consulting Engineer: *Silver Associates.* Contractor: *Joines Refrigeration, Inc.*

GAS-operated READY-POWER air conditioning achieves lowest known operating costs

In clubs, churches, theatres, bowling alleys, stores, factories . . . for every type of commercial and industrial air conditioning application...gas-operated Ready-Power units condition air with extremely low input per ton-hour.

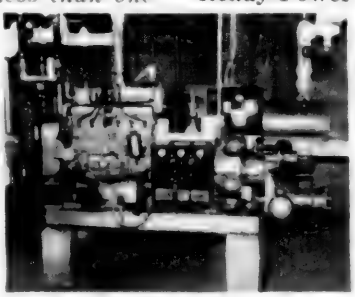
All Ready-Power units average less than 13 cubic feet of natural gas per ton per hour. What's more, the total operating cost amounts to *less than one cent per ton per hour.*

What makes this possible? Ready-Power air conditioning combines the unmatched fuel economy of gas with a unique variable speed operation.

LOADMATCH CONTROLS automatically adjust output and fuel consumption to actual cooling requirements. Cooling is constant, as opposed to the ON-OFF operation of some systems.

Get all the facts on the unusual economy and efficiency of gas-operated Ready-Power Air Conditioning. Call your local Gas Company, or write to the Ready-Power Company, Detroit 14, Michigan.

American Gas Association



Gas-operated Ready-Power Air Conditioning uses natural gas engine-driven compressor units, condensing units or matched chiller-condenser units. Ready-Power offers packaged systems with capacities from 20 to 110 tons.

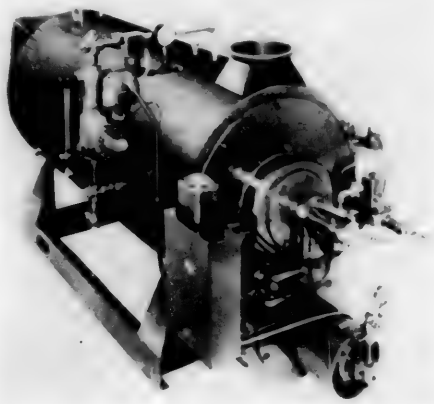
FOR AIR CONDITIONING GAS IS GOOD BUSINESS!

(Continued from page 112)

Small Boilers for Process Steam

Cyclotherm CE small boilers for use in food-processing, electro-plating, laundry, and other industries requiring small amounts of process steam or hot water are announced by Cyclotherm Div., Crane Co., Johnstown, Pa.

Six models are available, ranging from 16 to 60



bhp. Boilers are said to reach full power within 20 minutes from a cold start. Return tubes are arranged concentrically around a central furnace. Light oil burners utilize pressure atomizing type nozzles. Eighty percent efficiency is guaranteed.

Control system features automatic attachments of higher priced industrial equipment, the company states. Timer utilizes straight gas or combination light oil and gas units with solenoid valve controlling straight light oil units.

A full line of optional and auxiliary equipment is available.

More Information? Circle Item 68 on Inquiry Card.

Extended Ventilator Bases

A series of extended bases for roof ventilators is announced by Western Engineering & Mfg. Co., Los Angeles, Calif. Bases range in size from 15 to 48

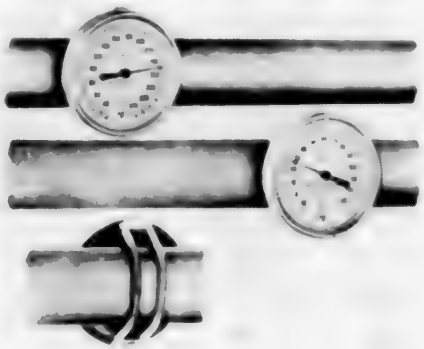
inches square, and are designed for use with low silhouette hooded exhaust ventilators.

Glass fiber insulation liner reduces air and motor noise. Available in galvanized or aluminum, bases are used to mount the ventilators on flat, slanted or peaked surfaces.

More Information? Circle Item 69 on Inquiry Card.

Thermometer Clips on Pipe

A pipe thermometer that clips to steam, water, refrigeration, gas and other pipes by means of twin spiral spring clips supplied with each instrument, is announced by Abrax Instrument Corp., Jamaica, N. Y.



Clips eliminate any need for branching or drilling. The thermometers are precalibrated to counteract the possibility of error through heat losses of radiation or convection.

They can be used for all pipes up to 3½ inches in diameter, and come in two temperature ranges: from plus 32 to 320 deg F and from minus 14 to plus 134 deg.

More Information? Circle Item 70 on Inquiry Card.

Thin Gage Flashing

Development of a thin-gage flexible sheet for elastic through-wall flashing and membrane waterproofing is announced by The Dow Chemical Co., Midland, Mich.

Trademarked Saraloy 200, the material is designed as a companion product to Saraloy 400 elastic flashing which has a successful ten-year field history. Saraloy 400, with a nominal thickness of 1/16 inch, is used for heavy-duty waterproofing and for flashings exposed to direct sunlight, while Saraloy 200, with a nominal thickness of 1/32 inch, is recommended for most waterproofing and flashing applications that do not involve direct sunlight. These include window heads and sills, spandrels, belt and base courses, foundations, tunnels, machinery pits, swimming pool aprons and shower pans.

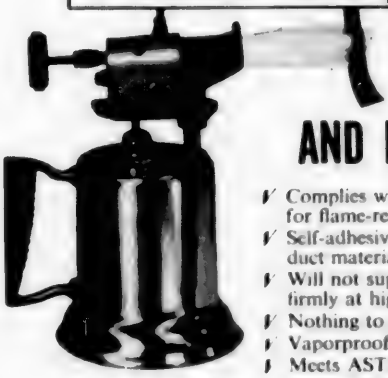
The new material is described as a tough, flexible sheet, finely embossed on one side to provide mechanical keying action in motor joints, self-extinguishing, water and corrosion resistant and easy to paint, to bond and to fabricate.

More Information? Circle Item 71 on Inquiry Card.

(Continued on page 116)

FLAME-RESISTANT

Arno DUCTAPE



FOR DUCTS AND INSULATION

- Complies with all building codes for flame-resistant duct tapes.
- Self-adhesive . . . sticks to any duct material or insulation.
- Will not support flame . . . holds firmly at high temperatures.
- Nothing to mix . . . saves labor.
- Vaporproof . . . waterproof.
- Meets ASTM standards.

Ask your jobber for DUCTAPE.

Write for **FREE** test sample!

ARNO ADHESIVE TAPES, INC.

Dr. Scholl's Adhesive Tape Division

4106 Ohio St., Michigan City, Ind.

NEW HY-DUTY

SMITH HYDRO-trol HYDROSTATIC SHOCK CONTROL

DESIGNED FOR BIG TOUGH JOBS

STOPS WATER HAMMER

CONTROLS *HYDROSTATIC* SHOCK

NOW YOU CAN SPECIFY SHOCK CONTROL BY HYDRO-TROL ON EVERY JOB

Time after time, and place after place where extreme hydrostatic pressures have caused other big shock controls to fail, we've installed this big, new Hy-Duty Hydro-Trol to test its ability to perform on the toughest jobs possible.

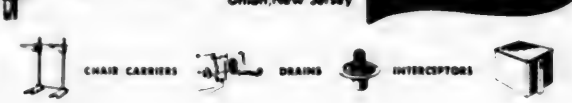
In all cases where this unit has been installed, it has proved unmatched for efficiency and effectiveness in absorbing and controlling the destructive pressures of hydrostatic shock, and eliminating resulting water hammer.

Specially engineered and sized for the rough duty of big tough jobs like commercial launderies, bus and truck washing stations, pumping systems, or any big piping system where extreme hydrostatic pressures, and shocks are encountered, this new Hy-Duty Hydro-Trol can be counted upon to deliver the same unequalled performance that has earned all six smaller sized Hydro-Trols the reputation of being the most efficient, effective and dependable line of shock controls ever made.

FOR FURTHER INFORMATION WRITE FOR YOUR COPY OF "SHOCK CONTOL BY HYDRO-TROL"

JAY R. SMITH MFG. CO.
Union, New Jersey

PLUMB-EASY



new **GOLD SEAL LINE TAP VALVES** by WATSCO

U.S. Pat. No. 2,827,913

- Provides a positive sealed port at low cost
- Test, charge, discharge a system in minutes
- Taps into any refrigeration line from 3/16" O.D. to 5/8" O.D.
- Easier installation from the top using two phillips type screws
- Larger threaded boss provides more strength and better sealing surface
- Features 3 point sealing
- Replaceable needle

Use with Gold Seal Swivel Control Valve CV-1G or CV-2G.

For additional information see your Wholesaler or write to Dept. V-12

CV-1G

CV-2G

Designed to operate all line tap, line port, can tap and access valves, Gold Seal control valves incorporate a swivel top adjustable to an easy working position.

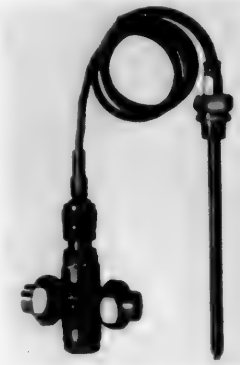
WATSCO INC

1020 E 15th STREET - HIALEAH FLORIDA

(Continued from page 114)

Thermostatic Cooling Regulator

Type 16 thermostatic cooling regulator, announced by Lawler Automatic Controls, Mt. Vernon, N. Y., is especially designed for use where a water bath is to be maintained at a constant temperature by the regulated addition of chilled water. It will also control many cooling processes very accurately, such as: engine jackets, molding platens, air compressors, and after coolers, the company states.



The manufacturer claims five points of superiority: (1) More compact construction for space-saving installations; (2) No valve stem friction and less maintenance due to its packless design; (3) Extreme sensitivity to minute temperature changes; (4) Very wide adjustability of range in 100 deg F increments; and (5) Suitability for original equipment manufacturers, where small quantities of accurately controlled water or other cooling mediums are required.

Regulator is currently available in ½ and ¾-inch sizes only. Both are fabricated with stainless steel trim, and 6 ft of armored capillary tubing with a standard range of 100-200 deg. Other ranges are available on request.

More Information? Circle Item 72 on Inquiry Card.

Electronic Vibration Guard

An electronic warning device for protecting equipment and processes against damage from excessive vibration is announced by Industrial Balancer Department, Stewart-Warner Corp., Chicago, Ill. It is sensitive to vibrations as minuscule as two-millionths of an inch amplitude, the manufacturer states.

A resonance-type vibration monitor, it stands sentinel on the machine, fan, grinder, turbine or other equipment which it is set to monitor—flashing a signal

or stopping the machine if safe limits of vibration amplitude are exceeded. It also becomes, with an accessory plug-in attachment, a portable balancer to be used in correcting the condition creating the vibration. The unbalanced, vibrating part can be corrected, in place and at once, in most cases.

A unique feature of the device, which multiplies its utility, is its tuneable pick-up, which filters out extraneous vibrations through mechanical resonance, thereby excluding all vibration frequencies except that for which it has been pre-set. It is also possible to "read" the vibrations of several bearings or units at the same time, by use of a channel scanner which automatically feeds into the monitor information transmitted from each bearing, in turn, by individual pick-ups, the company states.

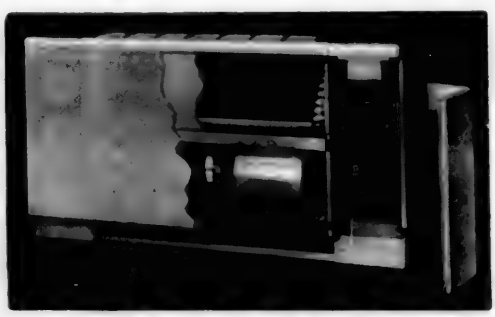
Some of the applications for which the new Stewart-Warner vibration monitor is being used include protection of gas turbine engines; pumps and motors at remote locations, and fans, impellers and blowers.

More Information? Circle Item 73 on Inquiry Card.

Remote Room Air Conditioners

Type *F* Fedair remote air conditioners with free-standing and recessed floor models and exposed and concealed overhead models are announced by Heating Div., Fedders Corp., Trenton, N. J.

Free-standing floor models measure only 8⅜ inches



from front to back, making them unusually compact both for new and modernizing installations. Features include: snap-on front panel, completely insulated coil compartment, factory installed manual air vent, 1080-rpm fan motor with high-capacity blowers for unusually quiet operation, fan motor disconnect plug, tap-wound motor which eliminates reactor for push button speed control.

More Information? Circle Item 74 on Inquiry Card.

New Colors for Washfountains

Bradley Washfountain Co., Milwaukee, Wis., is offering stainless steel washfountains with six harmonizing pedestal colors in addition to standard metallic: yellow, blue, green, tan, mint green, and white. Marmorite bowls are offered in four color choices; vitreous enameled washfountains in six choices.

Color choices are in response to demands of architects and designers who are seeking color for warmth and attractiveness for washfountain installations in washrooms, hallways, classrooms, in alcoves near lunchrooms, and a variety of industrial applications.

More Information? Circle Item 75 on Inquiry Card.

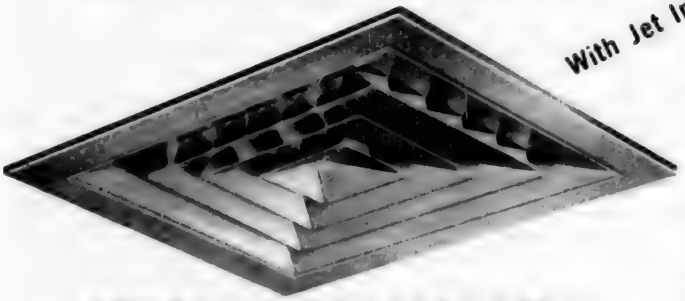
(Continued on page 118)

THE ORIGINAL SQUARE AND RECTANGULAR AIR DIFFUSERS

AGITAIR®

GENUINE PRODUCTS

With Jet Induction Diffusing Vanes



STURDILY CONSTRUCTED

- All louvers are firmly welded to diffusing vanes in parallel lines.
- The louvers cannot be tampered with or altered.
- Solid construction eliminates strumming or vibration.
- A metal plate is welded at the corner joints to add greater rigidity to the unit.

MORE THAN 1,000,000 IN USE TO-DAY

Only AGITAIR square and rectangular diffusers employ the jet induction feature due to scientically designed diffusing vanes.

These AGITAIR diffusers with built-in diffusing vanes, are designed and positioned to serve as air pumps, compressing the air into a multiplicity of jets. These jets issuing from spaces between adjacent louvers, produce a high degree of turbulence which rapidly mixes the primary and room air and assures control of the entire cubicle contents of the spaces served.

AGITAIR jet induction type diffusers are custom-made with louver arrangements for 1-2-3 or 4 way proportional blows.

Ask for technical catalog R-108

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AIR DISTRIBUTION • AIR CLEANING • AIR EXHAUST

BOOKS

. . . give you the answers to your design problems. And it's easy to build your reference library with the useful volumes described on the insert sheet inside the back cover. Just use the prepaid order card to get the ones you want. THE INDUSTRIAL PRESS, Publishers, 93 Worth Street, New York 13, N. Y.

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U. L. APPROVED **PRESSURE BURNERS**

DUAL-FUEL GAS OIL

The Prestige Burner

Designed for the hard-to-fire jobs. Fires all types of boilers, warm air furnaces, and ovens. Standard features are "extras" on other burners. Flame retention . . . controlled flame pattern . . . rotary action flame . . . automatic fuel-air ratio . . . latest electronic safety control . . . polished aluminum housing. Factory wired and fire-tested.

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SYNCHRONOUS FLAME, Inc., 227 N. Main St., Walworth, Wis.

for your convenience / ***SPRAY NOZZLES*** *and all related accessories for*

HUMIDIFYING / *from a single, dependable source*

PRECISION PNEUMATIC ATOMIZING NOZZLES

ACCESSORIES SUCH AS AIR FILTERS, HUMIDISTATS, SOLENOID VALVES, PRESSURE REGULATORS

COMPACT HUMIDIFYING UNITS

For industrial installations of every size Spraying Systems offers all needed equipment . . . everything but the piping, wiring and compressor. Provides high efficiency, dependable system; only two components have moving parts. Engineered for easy installation and simplified maintenance.

WRITE FOR Bulletin 82 . . . spray nozzles, assemblies and parts for manual or automatic humidifying systems.

ALSO SUPPLIED . . . spray nozzles for evaporative condensers, air washers, cooling towers, spray ponds and roof cooling systems.

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3261 RANDOLPH STREET • BELLWOOD, ILLINOIS

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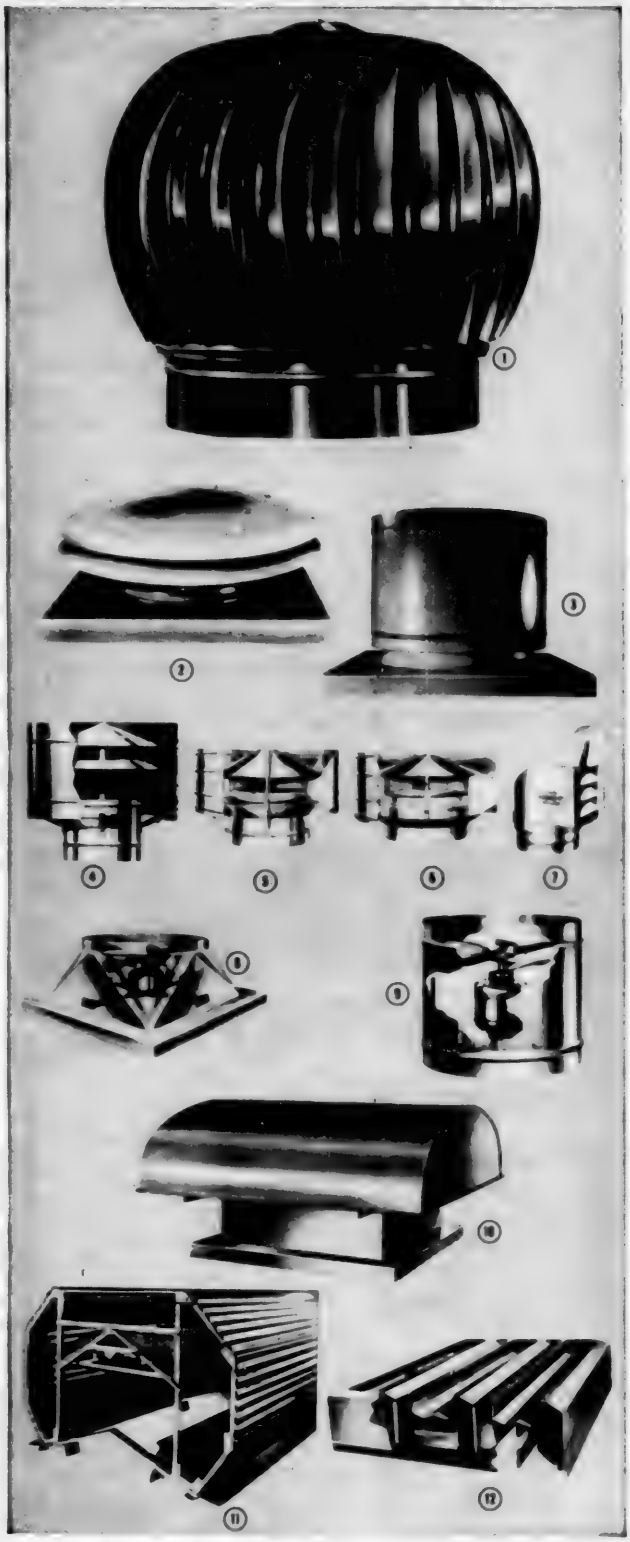

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WESTERN ENGINEERING AND MFG. CO.

P.O. Box 66455
Los Angeles 66, California

Complete Catalog in Sweets. Member Air Moving and Conditioning Assoc., Inc.

(Continued from page 116)

Floor-Type Water Coolers

Five floor-type water coolers, said to save as much as 25% in space, will be offered in 1961 by Cordley & Hayes, New York, N. Y. The Cordwall units feature concealed plumbing, flush-wall installation or free-standing, and air-cooled or water-cooled models, it was announced.

Units can be tied to plumbing in the wall or through the floor, and provide connections for remote fountains and glass fillers.

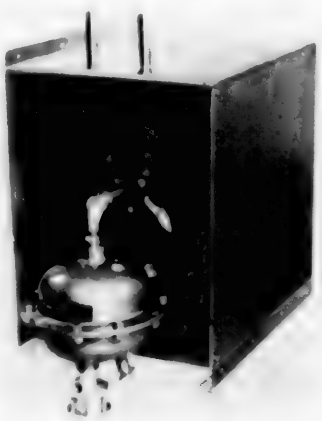
Coolers range from 6 to 22 gal per hr (standard industry rating). Each is equipped with both a push button finger control and a foot pedal 12 inches wide. The automatic stream pressure regulator and thermostat are adjustable.

As with all of the company's coolers, the sealed refrigerant and water systems are protected by a five-year guaranty. The units comply with all sanitary codes and requirements of Commercial Standards CS127-45 of the National Bureau of Standards.

More Information? Circle Item 76 on Inquiry Card.

Dryer Guards Pneumatic Controls

Series E economy model non-cycling air dryer is engineered for protection of pneumatic controls by Hankison Corp., Canonsburg, Pa.



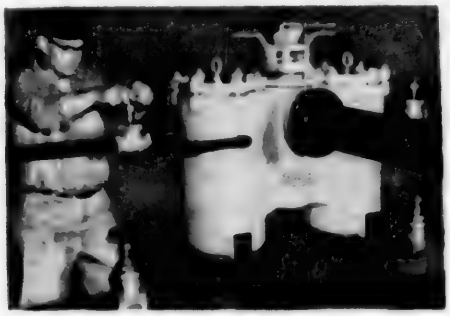
With its 10-scfm at 100 psig rating, it is well suited for air conditioning and ventilating controls systems, as well as printing press and other pneumatic feeds, the company states. Mechanical refrigeration unit needs no cooling water, can be floor or wall mounted.

Dryer is available as a basic unit (no trap), or equipped with either the company's Mag-Pneu-Power automatic trap or with an Armstrong No. 21 trap.

More Information? Circle Item 77 on Inquiry Card.

Pipeline Strainers Clean Quickly

Savings in labor of up to 90% are said to be possible with a line of backwash pipeline strainers introduced by Fluid Control Div., Zurn Industries, Inc., Erie, Pa. There are no bolts, covers, or straining ele-



ments to remove or replace, and no special tools needed, the company states. A reverse flow of backwash fluid rinses strainer free of all foreign matter at the turn of a valve, discharges debris-laden waste directly into existing drainage system. Maintenance personnel are never exposed to toxic, caustic, or noxious fluids, or high temperature water. Strainers are available in single or double gate- or plug-type models accommodating a full range of pipeline diameters.

More Information? Circle Item 78 on Inquiry Card.

Electric Light and Heat

Quartzheet, a surface mounted infrared heater and lighting fixture with a circular quartz heat element is announced by Infrared Corporation of America, Westbury, L. I., N. Y.

Rated at 800 watts and 120 volts, the unit boasts

a 24 karat gold plated reflector said to reflect 40% more heat and effectively resist weather damage.

According to the manufacturer, the circular element is a significant advance over the straight quartz tube in that its output can be optically focused to spot heat any area with a uniform warmth. Principal applications foreseen are in bathrooms, guard houses, patios, cottages, sidewalk bank teller booths, outdoor restaurants, etc.

More Information? Circle Item 79 on Inquiry Card.

For Air Conditioning

Thermal expansion valve set accurately in less than a minute with the . . . . .

Alnor PYROCON®

Eliminate the clumsy, slow thermometer method of determining temperatures in the system.

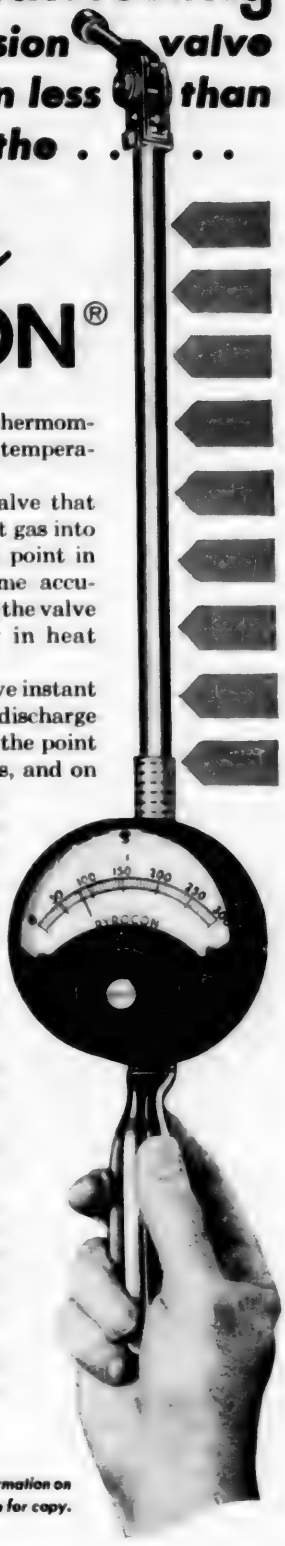
The thermal expansion valve that meters the flow of refrigerant gas into the cooling coil is a critical point in any cooling system. Extreme accuracy is necessary in adjusting the valve to obtain peak efficiency in heat absorption.

The Alnor Pyrocon will give instant temperature readings at the discharge side of the expansion valve, the point where heat absorption starts, and on the outlet of the coil where the total heat absorbed is registered. The temperature differential enables the operator to make a perfect setting of the expansion valve immediately.

Pyrocon model 4000 with a temperature range of 0-300° F. is recommended. Price with case including shielded thermocouple tip $125.00 f.o.b. Chicago.

The Pyrocon is also ideal for testing steam traps, balancing hot water systems, locating hot water pipes in cement floors, testing panel heating in walls, floors or ceilings, or making any surface temperature reading.

Other models with ranges up to 0-2000° F. and sub-zero ranges also available.



Bulletin No. 4257 contains complete information on the full line of Pyrocon instruments. Write for copy.

Alnor INSTRUMENTS

ALNOR INSTRUMENT CO.
Division of
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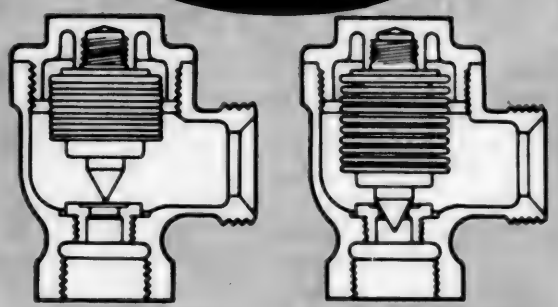
Rm. 570, 420 N. LaSalle St., Chicago 10, Ill.

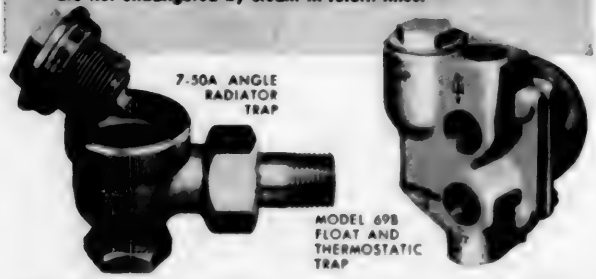
SIMPLE, TROUBLE-FREE VACUUM THERMOSTAT DESIGN ASSURES EFFICIENT, ECONOMICAL STEAM TRAP OPERATION

Sterlco
STEAM TRAPS



Thermostat in open position — Thermostat in expanded position

1. Sterlco Traps operate efficiently regardless of pressure variations. Vacuum thermostat compensates for pressure changes.
2. While vacuum in thermostat remains intact, traps require no attention other than normal maintenance.
3. If, through damage or normal wear, the vacuum is lost, the thermostat expands, closing off trap and radiator. Locating source of trouble is made quick and easy. Trap maintenance is greatly simplified.
4. Closed traps mean no wasted steam . . . vacuum on vacuum systems remains normal . . . condensation and vacuum pumps are not endangered by steam in return lines.



The Sterlco line covers the whole range of low, medium and high pressure radiator traps. Every unit thoroughly tested . . . components inspected and tested during manufacture; completed traps given operating tests before shipment. Thermostats and seats replaceable without shimming or adjustment.

Sterlco F & T traps perform dual function: float trap releases condensate water . . . thermostatic trap vents air. No. 69B has two inlets, two outlets making four installation positions possible . . . saves time, space and piping.

For complete information on Sterlco Steam Traps, write for Bulletin 102.

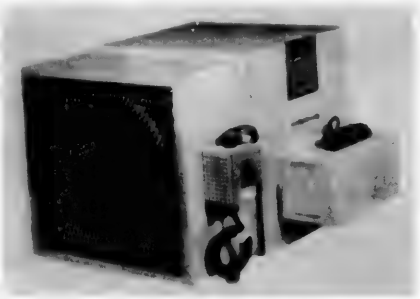
Leaders in temperature controls since 1916

Sterling inc.

5202 W. Clinton Ave., Milwaukee 23, Wisconsin

Portable Air Cleaner

Model TFA high-capacity portable electronic air cleaner, manufactured by Trion, Inc., McKees Rocks, Pa., is a commercial room unit for areas where lack of ductwork prevents installation of a centralized system. It may be used in restaurants, cocktail lounges,



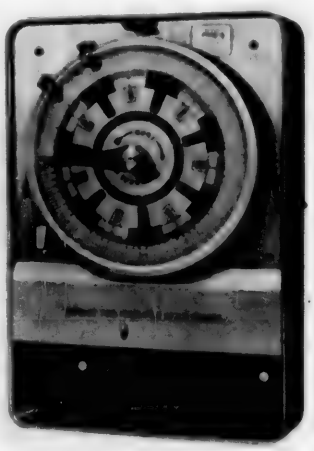
hotel and motel meeting rooms, offices or for any application when localized clean air is desirable.

Unit has the capacity to clean air in a 9000-cu. ft. room with a complete air change every 10 min. It will remove smoke, dirt, dust, pollen, and germs. In larger areas, multiple units may be used.

More Information? Circle Item 80 on Inquiry Card.

4-Pole Switching for Timers

Addition of several 4-pole switching options in its 7-day and 24-hour time switch lines is announced by Paragon Electric Co., Two Rivers, Wis. Said to be the only UL-approved 4-pole switching arrangements for 3-phase lighting applications in the industry, the options also offer automatic and simultaneous control of four separate circuits and adaptability for all switching combinations. The switching options were designed especially for heating, ventilating, lighting, and air conditioning applications in schools, public buildings, stores, factories, and offices.



Four-pole switching accomplishes the same results in both the 24-hour and 7-day time switches. Both can be wired 4-pole single-throw — with four normally open, isolated contacts—for 3-phase lighting applications or 4-circuit control. Wired in this manner, each pole has a 20-amp tungsten load rating.

More Information? Circle Item 81 on Inquiry Card.

Pressure Sensitive Type Sheet

A pressure sensitive type sheet offered by Applied Graphics Corp., Glenwood Landing, L. I., N. Y., can be used by untrained personnel to set headings, titles,

and notations for reproduction by Diazo or photographic methods.

Each character is individually slit. A pointed tweezer is used to peel a character and place it in position. Characters can be lifted easily and removed to any position without loss of adhesive, the company states.

More Information? Circle Item 82 on Inquiry Card.

Thermometer Adjusts Three Ways

Adjust-All liquid-in-glass industrial thermometer, presented by Weksler Instruments Corp., Freeport, N. Y., combines three adjustments which permit complete 360° change of angle on the case and stem, plus variations of stem length. All adjustments can be made in the field and need not be specified when ordering.

More Information? Circle Item 83 on Inquiry Card.

Compact Whiteprinter

Development of Copymaster, a compact table or wall mounted 44-inch whiteprinter for engineers, school, and office use, is announced by Copymation, Inc., Chicago, Ill.

Unit has a variable printing speed range up to 10 ft per min. Chamber processes several prints simultaneously. According to the manufacturer, sharp prints are produced from any translucent material, and excellent intermediates and sepias are also made. Black light fluorescent lamps provide the light source. Unit plugs into standard electrical outlet.

More Information? Circle Item 84 on Inquiry Card.

GREAT THINGS HAPPEN WITH

CONTROLLED-AREA SPOT HEATING

HIGH ENERGY INFRA-RED EMITTER—WITH FUSED QUARTZ ELEMENT GIVES INSTANT WARMTH

COMPACT, HIGHLY-DECORATIVE FIXTURES TO ENHANCE ANY INTERIOR/EXTERIOR DECOR

DUAL USE, COMFORT OR HEAT-PROCESSING OPERATIONS

HIGHER HEAT EMISSION, HIGHER HEAT TRANSFER

CEILING, WALL OR PORTABLE WALL-HANGING MOUNT TYPES.

BASED ON PROVEN-PRACTICAL EUROPEAN CONCEPT — U.L. APPROVED

INSTALLS RIGHT TO EXISTING CONDUIT WITHOUT STRUCTURAL CHANGE

ECONOMICAL, HIGHLY EFFICIENT, SAFE

THERMAL SHOCK RESISTANT: ATTRACTIVE PROTECTIVE GRILLE

3 FIXTURE SIZES: 10 MODELS

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MODERN NIAGARA CONDENSERS PAY FOR THEMSELVES IN EXTRA SAVINGS

These Niagara condensers are lower in first cost and assure you of trouble-free automatic refrigeration. Special features: "Aeropass" coil removes super-heat to give you condensing at lower temperatures and prevent loss of capacity by the scaling of condenser tubes; "Oil-out", oil separator between pre-cooling and condensing coils gives you always an oil-free system; "Panel-Casing" construction gives you access to every part of the condenser for inspection and maintenance. Operating engineers say these condensers "save half the work of running a refrigerating plant". Managers who know costs and profits prove that Niagara condensers bring them great returns in power savings, water savings and reduced maintenance expense.

Write for Bulletins 131 and 142.

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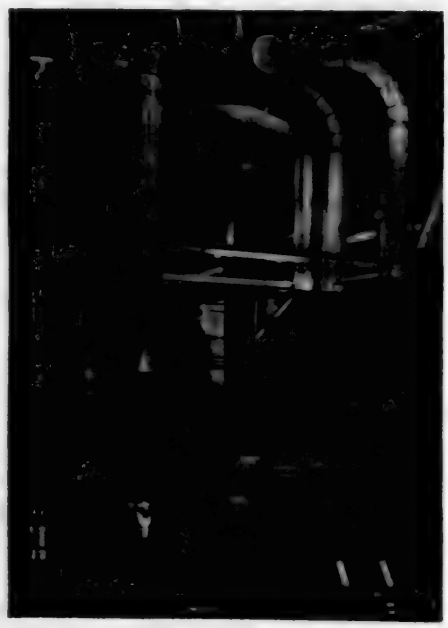
Niagara District Engineers in Principal Cities of U. S. and Canada

YOU SAVE MORE WITH FLEXAUST® HOSE



Thousands of successful installations prove that use of Flexaust hose and Portovent retractable duct with metal duct systems lower installation costs – but there are other important advantages

Exceptional abrasion resistance
Corrosion resistance
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Durability under heavy flexing
Provision for expansion and contraction
Easy relocation of hoods and machines

Made of high quality neoprene coated fabrics 1¼ to 36" i.d.

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NEW YORK 17, N. Y.

INDUSTRIAL HYGIENE MEETING

(Continued from page 16)

corrosion by use of fan housings with inspection door and drain plug. Some other tricks of the trade: A hole in the tail guard over the end of the fan shaft will allow easy insertion of a tachometer. Fan housings which are not required to support the duct work to which they are attached can be moved with minimum construction rigging.

Dust collectors need more care and inspection than the rest of the system. A few pointers for the design engineer: (1) Specification and selection of dust collecting equipment should be as thorough as for major production equipment. (2) Pilot scale tests of collectors are warranted on important new applications. (3) Design for continued use and easy maintenance. (4) Obtain opinions of other users of similar equipment. (5) Specify special features in the original equipment to minimize maintenance. (6) Insist that venders furnish maintenance manuals, parts lists and instruction books.

During and following construction of a dust control system, complete inspection and testing should be made, the system should be started up, air flow checked in all branches, gages calibrated, moving parts and controls put through their paces. The system should be watched in operation for several days and production start-up. Users and operators must be carefully instructed. Prepare an operation manual showing not only what to do but why it is done, what to check, danger signals, parts to keep in stock. The make, model and serial number of major equipment should be included in a permanent body of information for the operator. Where the system is complicated a training program may be called for. Even for simple systems, operating personnel should be carefully briefed and their enthusiasm for the purpose of the system enlisted.

If possible a preventive maintenance and inspection system should be set up. This should include (1) an itemized schedule of what to inspect and (2) details of what to look for on each item.

In summary, the six steps to better operation of a dust control system are:

1. Management must decide the investment is worthwhile although returns may be intangible.
2. Design carefully with attention to detail and awareness of tricks of the trade.
3. Give thought to devices for access, gages, inspection and maintenance.
4. Test the system before putting into service.
5. Educate the users and maintainers of the system.
6. Set up preventive maintenance and inspection schedules.

ARCHITECTS, GENERAL CONTRACTORS PLEDGE CONTINUED FRIENDSHIP

A joint statement was issued by the American Institute of Architects and the Associated General Contractors of America, reaffirming their "traditional views regarding the respective roles of architects and the general contractors in the construction industry."

AIA's current efforts to explore means by which its members can increase the scope of their service will not affect, and are not intended to affect, the role of the general contractor or the present system of building contract administration, the statement said. AIA proposes the establishment of a new committee known as AIA-AGC Liaison Committee, replacing the AIA-AGC Joint Cooperative Committee.

The new name is said to reflect more truly the scope and responsibilities of the joint committee. However, the work and activities would continue as in the past.

Coupled with an internal reorganization now in progress, a special committee of AIA is re-evaluating the architect's professional role in the industry with special attention to "package deals" and similar problems.

For the past two years a special AIA Committee on the Profession

TYPE GP
CLOSE-COUPLED
CENTRIFUGAL

CUT PUMP COSTS

USE AURORA CENTRI-PAC PUMPS

CAPACITIES TO 400 GPM / HEADS TO 150 FEET

NOW AVAILABLE IN 11 PACKAGED SIZES

AIR CONDITIONING EQUIPMENT / CIRCULATING SERVICES / GENERAL SERVICES

- LOWER IN COST . . . made possible by standardization of most popular sizes packaged and stocked for immediate off-the-shelf shipment.
- EXTREMELY COMPACT . . . close-coupled design saves valuable space and is more easily installed.
- HIGHLY EFFICIENT . . . low horsepower requirement means less initial cost and lower operating expense.
- EASILY MAINTAINED . . . pump can be completely disassembled for inspection and repair without disturbing the piping.
- QUALITY CONSTRUCTION . . . bronze fitted, mechanical seals, drip-proof NEMA rated motor with stainless steel shaft and built-in overload protection, and cast bronze impeller keyed and locked in position.
- SMOOTH, QUIET OPERATION . . . low NPSH meets critical suction conditions.

You may also select from a complete line of horizontal or vertical mounted pumps and flexible-coupled pedestal-mounted pumps engineered to your specific requirements.

WRITE FOR BULLETIN 117 PKG

AURORA always PUMPS

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THE NEW YORK AIR BRAKE COMPANY
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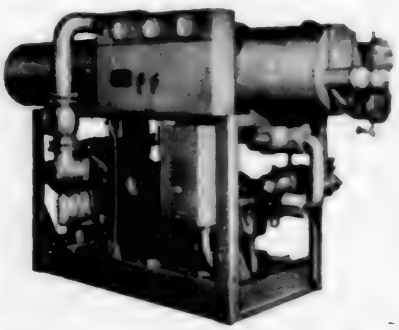
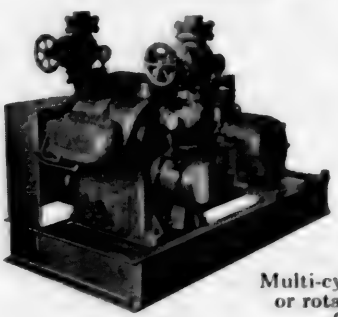
"IT HAD TO BE YOU" ... VILTER is an often said and a well founded chorus among many leading American companies when it comes to selecting quality refrigeration and air conditioning equipment. (A few of the thousands of valued Vilter customers are shown above.) They all consistently look to Vilter for sound refrigeration and air conditioning recommendations and for reliable, efficient-performing, economical-to-operate equipment.

Vilter equipment finds wide application in all industries where refrigeration and air conditioning are used—from industrial installations in meat packing and poultry plants, dairies, breweries, refrigerated fishing vessels, frozen food plants—to air conditioning systems in important hotels, motels, office buildings and hospitals.

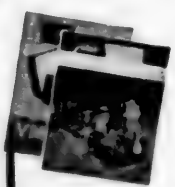
With a complete line of industrial and commercial refrigeration and air conditioning equipment, Vilter can provide a system to exactly fit your needs.

Packaged water chillers for air conditioning.





Multi-cylinder, vertical or rotary compressors for refrigeration and air conditioning.



Vilter® refrigeration air conditioning

The Vilter Manufacturing Company
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Air Units • Ammonia and Freon Compressors • Booster Compressors Baudelot Coolers • Water and Brine Coolers • Blast Freezers Evaporative and Shell and Tube Condensers • Pipe Coils Valves and Fittings • Pakice and Polarflake Ice machines.

Write for your copies of bulletins covering the above equipment to The Vilter Manufacturing Company, Dept. G-606 2217 South First Street Milwaukee 7, Wisconsin

has been considering the problems in the light of technical advances, industrial growth, changes in contract procedures, and economic developments. The committee published "A Report on Your Profession" in the June issue of *The AIA Journal* and AIA and AGC officials at the Las Vegas meeting agreed that parts of the report, including the description of architects as "master builders," was subject to misinterpretation.

In a clarifying statement the AIA stated that it *neither recommends that architects replace general contractors nor endorse separate contracts.*

1962 NATIONAL ARI SHOW TO BE HOSTED BY WAC

A national show of Air Conditioning and Refrigeration Institute (ARI) will be held in California for the first time. It is scheduled for the Los Angeles Great Western Exhibit Center, February 12-15, 1962.

Because of the importance of this national event, Western Air Conditioning Industries (WAC) Association has cancelled its arrangements for their 1962 show. Instead, Association members will act as hosts at the ARI show. Arthur J. Hess, WAC vice-president and past president of ASHRAE, will be in charge of all technical sessions.

Fred J. Tabery, exhibit manager of the biennial WAC event, is notifying all exhibitors of the change in plans and returning deposit checks. He expressed the hope that exhibitors would contact George E. Mills, ARI show director, 1346 Connecticut Avenue, N. W., Washington, D. C., to make arrangements for exhibiting in the national show.

Rudy Berg, ARI president, in a letter to Mr. Tennity and the WAC board of directors stated, "We at ARI are particularly grateful to you for the spirit of understanding and co-operation and we look forward to a successful industry exposition and to an outstanding and interesting program."

BRIEFLY STATED

NEWS ITEMS

Construction costs in the United States (excluding Alaska and Hawaii) rose another 1% between April and October of this year, according to Myron L. Matthews, manager-editor of the DOW BUILDING COST CALCULATOR. The Calculator measures changes in the cost-to-build of over 650 building types on a semi-annual basis. Results of the study are released by F. W. Dodge Corp., New York City, as a public service.

Coupled with a 1% increase reported for the six-month period prior to April, this means that construction costs have increased 2% during the past twelve months.

This increase is based on an averaging of building materials prices and hourly wage data sampled in 144 metropolitan areas throughout the country. Other elements of cost taken into consideration include design, taxes, insurance, money and competitive conditions.

Mr. Matthews forecasts an annual increase of from 3—4% in construction costs in 1961 . . .

Manufacturers' shipments of unitary air-conditioners reported to AIR-CONDITIONING AND REFRIGERATION INSTITUTE for the first six months of 1960 totaled 185,474 units, excluding coils, a gain of 15% over first-half 1959 shipments recorded by ARI. It is estimated that units reported to ARI represent more than 90% of the industry total.

The six-months figures represent a healthy trend, according to ARI spokesmen, in view of the fact that the first quarter figures showed a gain of but 10% over the comparable period of 1959. Figures include unitary heat pumps, but do not include room air-conditioners, reversible or otherwise . . .

(Continued on following page)

which size stack do YOU prefer?

Each does the same job—the smaller one is equipped with a Lehigh Induced Draft Fan

Lehigh Induced Draft Fans are designed to help eliminate large, costly, unsightly stacks. They maintain a *constant* over-fire draft regardless of atmospheric conditions, help keep boilers operating at *maximum* efficiently at all times, and significantly *lower fuel bills* . . . while radically *reducing* the size of your stack.

Rugged Construction—long life: to prevent distortion under elevated temperature conditions, the fan housing, bearing pedestal, motor support and fan wheel of Lehigh Draft Induced Fans are constructed of all-welded integral 3/8" mild steel. A radiant heat cover and an aluminum heat flinger protect the inboard bearing from radiated heat. And because both bearing and shaft are kept to a low operating temperature, the Lehigh Induced Draft Fan makes use of standard, self-aligning ball bearing pillow blocks. *All* Lehigh Induced Draft Fans feature a flanged inlet, flanged outlet, and inspection cover as standard equipment.

If you would like to reduce stack height . . . and gain optimum boiler efficiency . . . contact your local Lehigh Representative today. He'll gladly give you all the details. Or write directly to us for our detailed technical bulletin:

2171
LF-1

LEHIGH FAN & BLOWER DIVISION
FULLER COMPANY, CATASAUQUA, PA.
Subsidiary of General American Transportation Corporation

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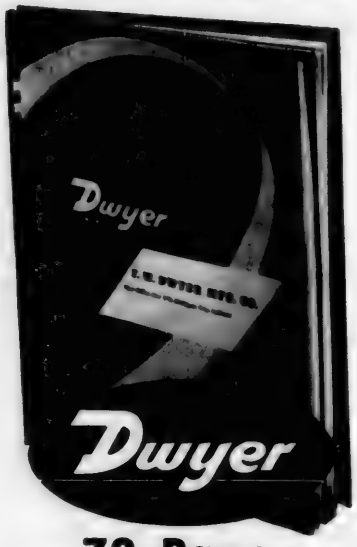

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RENSSELAER POLYTECHNIC INSTITUTE, Troy, N. Y., announced a new program designed to open its doors to young women who want to study engineering, science and architecture. Rensselaer and its neighbor, Russell Sage College, a liberal arts school for girls, will undertake in September, 1961, a program of affiliation whereby the female students will live at Sage and study at Rensselaer.

It will be possible for women to earn engineering, science and architecture degrees at Rensselaer while enjoying the residential facilities of Sage and social and extracurricular life of both colleges.

WITH THE ENGINEERS

Olof Lindquist and Jim Griffith announce a change of firm name from K. J. Murray & Associates to LINDQUIST & GRIFFITH. New offices of the electrical and mechanical consulting engineering firm are at 850 Lincoln St., Denver, Colo. . .

Appointment of John E. Boyle as director of procurement for FRICK COMPANY, has been announced. He is a graduate electrical engineer from the University of Toronto . . .

DUNHAM-BUSH, INC., West Hartford, Conn., appointed Russell S. Townsend as chief engineer for its Michigan City, Ind., plant. Mr. Townsend will head all engineering activities at Michigan City for its air conditioning, heating and refrigeration products . . .

BURGESS JENNINGS, professor of mechanical engineering, returned recently to Northwestern University after a 3-year leave during which he was director of research for the American Society of Heating, Refrigerating and Air-Conditioning Engineers. He had been chairman of the mechanical engineering department at Northwestern from 1943 to 1957. A project he hopes to begin soon is an examination of minimum fresh air requirements for schools . . .

Herbert J. Zurstadt has joined the engineering department of DETROIT CONTROLS DIVISION of American Radiator & Standard Sanitary Corporation, Detroit, Mich., as a project engineer. He will supervise the division's combined refrigeration and air conditioning and commercial-industrial control project engineering teams. Mr. Zurstadt comes from Ranco, Inc., where he has been a project engineer since 1958 . . .

Philip F. Little has been named consultant for special applications of centrifugal refrigeration machines for CARRIER AIR CONDITIONING CO., Syracuse, N. Y. He will have over-all responsibility for advising on non-standard uses of both open and hermetic type centrifugal chillers . . .

THE JOSAM MANUFACTURING COMPANY announced the appointment of Louis Blendermann as vice-president, in charge of its research and engineering program. Mr. Blendermann received his formal civil engineering education at Brooklyn Polytechnic Institute and is a well known authority in the field of piping and plumbing. His background in the plumbing industry includes experience as a plumbing and heating contractor, designer, engineer and chief engineer for several major consulting firms. Recent experience covers the manufacture of plumbing products, wherein he served as Director of Research and Engineering for Jay R. Smith Mfg. Co.

A member of the American Society of Sanitary Engineering, he is the author of "Design of Plumbing and Drainage Systems" and a monthly series, "Plumbing and Piping" in this magazine. Both the book and the magazine are published by The Industrial Press . . .

K. Albert Miegl has been appointed chief engineer of ARKLA AIR CONDITIONING CORP., Evansville, Ind., and Little Rock, Ark., and Robert K. Spear has been named assistant to the vice president — engineering, research and development, the company announced. Mr. Miegl succeeds Dr. Phillip P. Anderson, who recently was promoted to vice-president in

charge of engineering, research and development . . .

KRUSE, FLAHERTY & ASSOCIATES, consulting engineers of Wayne, N. J. announced opening of their new offices in Jersey City, N. J. This firm is engaged in the engineering and design of commercial buildings, industrial plants, and environmental and other specialized test facilities.

Mr. H. E. Kruse and Mr. E. J. Flaherty, the principals of the firm, are both very active in the New Jersey Society of Professional Engineers, the announcement states.

Mr. Kruse, a New York University graduate was formerly with McConathy, Hoffman & Associates. Mr. Flaherty, a graduate of Stevens Institute, was formerly with Tenney Engineering and McConathy, Hoffman & Associates . . .

R. L. Hagensick has been named chief engineer of Heating and Air Conditioning Div., MODINE MANUFACTURING COMPANY, Racine, Wis. Appointment of Mr. Hagensick is designed to strengthen over-all product development and research activity in the heating and air conditioning fields.

ASSOCIATION ITEMS

Election of Robert W. Krogstad to the post of association president is announced by AIR MOVING & CONDITIONING ASSOCIATION, INC., Detroit, Mich. About one hundred AMCA members, representing sixty-six manufacturers of air moving and conditioning equipment, held their sixth annual meeting in Hot Springs, Va., in September, outlined industry plans for 1961, and elected a new president and board of directors. Mr. Krogstad, replacing retiring president Earl Trickler of New York Blower Co., has served for the past three years as executive vice-president and general manager of Carnes Corp., Verona, Wis. . . .

Hugh T. Williams, manager of engineering and industrial sales, Owens-Corning Fiberglas Corp.,

Satisfy more "tough clients" with Reznor

REZNOR direct-fired DUCT FURNACES CUT CENTRAL HEATING COSTS

You avoid the expense of boilers, piping and controls when you use Reznor direct-fired duct furnaces.

These features cut installation time and costs:

- mounting pipes at all four corners permit easy suspension or base mounting;
- double-lip flange simplifies air-tight connections;
- air can flow through heat exchanger in either direction;
- controls can face each other when heaters are in tandem;
- built-in draft diverter is reversible;
- flue collar is interchangeable for horizontal or vertical installations.

These features insure long-run economy, easy maintenance:

- Reznor furnaces have long-lasting, corrosion-resistant aluminized or stainless steel heat exchangers and non-clogging steel burners, easily accessible from front or rear;
- every furnace is flame-tested and shipped complete with U/L approved controls.

Whatever system you're planning—central heating, year-round air conditioning, make-up air, process air—Reznor fills any requirement. Heaters may be used singly in capacities up to 300,000 Btuh, or in tandem or side-by-side arrangement for greater heating requirements. Reznor blowers available. Ask your Reznor representative for Catalog SA-5900. Or write Dept. 64S, Reznor Manufacturing Co., Mercer, Pa.

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"WORLD'S LARGEST SELLING DIRECT-FIRED HEATERS"

You Can Do It FASTER with BAKER SCAFFOLDS

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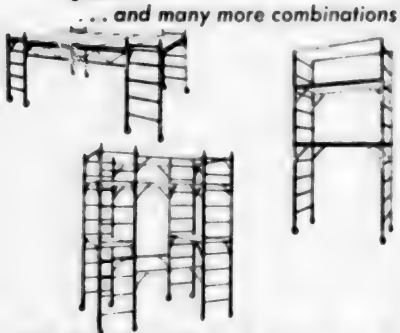
You Can Do This

... and many more combinations



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Gentlemen: Send the folder described on Baker Scaffolds without obligation.

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Organization_____

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DISTRIBUTORS IN PRINCIPAL CITIES

Briefly Stated

New York, has been elected president of NATIONAL INSULATION MANUFACTURERS ASSOCIATION. The new vice president of NIMA is Emil T. Johnson, vice-president of Union Asbestos & Rubber Co., Bloomington, Ill. Ike Keith, president of Forty-Eight Insulations Inc., Aurora, Ill., is the new treasurer. John M. Barnhart is executive secretary, with offices at 441 Lexington Avenue, New York 17. NIMA members are manufacturers of inorganic thermal insulations.

The following have been appointed as heating and cooling coil representatives by Heating and Air Conditioning Department, Danville Div., BOHN ALUMINUM AND BRASS CORPORATION: T and H Co., Seattle, Wash.; J. C. Kelley Co., Spokane, Wash.; ATM Equipment Co., Jackson, Miss.; R. F. Zimmerman & Co., Shreveport, La.; L. S. Pawkett & Co., San Antonio and Corpus Christie, Tex.; C. Kelsey Sanders, Miami, Fla.; Henry G. Graham, Tampa, Fla.; and Earl Siebert, Ponte Vedra, Fla. . .

Con-Dea Supply Corporation, 379 E. 169th St., Bronx, N. Y., have been appointed as stocking jobbers in the Metropolitan New York area for horizontal-discharge gas-fired heaters made by L. J. WING MFG. Co., Linden, N. J. Con-Dea will maintain a complete stock of Wing gas-fired unit heaters and duct heaters, as well as stocks of parts and accessories . . .

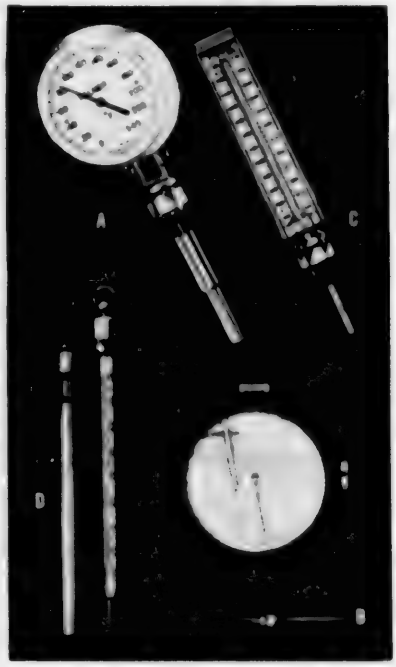
Appointment of Air-Pak Products, Inc., as sales representatives for ULOK Cube air filters in New York and New Jersey was announced by Union Carbide Development Company, Division of UNION CARBIDE CORPORATION. Air-Pak Products is located at 415 Lexington Avenue, New York 17, New York . . .

LAWLER AUTOMATIC CONTROLS, INC., Mt. Vernon, N. Y., announces the appointment of Vermont Plumbers, 3423 South Vermont, Los Angeles, Calif., to be service and parts representatives for Southern California. This appointment assures a complete line of re-

A GREAT NAME IN THERMOMETERS

PALMER

Mercury Actuated Temperature Indicating Instruments



A—4½" DIAL THERMOMETERS: Made in 3 types to suit any requirements. Rigid stem, wall or flush mounted, 11 inches of scale reading. Interchangeable with standard industrial separable sockets. Stem can be placed at any angle and case can be rotated to any readable position.

B—RECORDING THERMOMETERS: Twelve inch die-cast aluminum case with black finish. Single or multiple pen construction. Electric or spring wound clock, 24 hour or 7 Day Revolution. Flexible Armor and bulb of stainless steel. Ranges: —40 +950° F or Equivalent in °C.

C—INDUSTRIAL THERMOMETERS: Red-Reading Mercury—Extruded brass case—chrome finish. Ranges: —40 +950° or Equivalent in °C.

D—RED-READING MERCURY LABORATORY THERMOMETERS: Thoroughly annealed for permanent accuracy. Complete line A.S.T.M. and fractional division types.

FOR COMPLETE INFORMATION WRITE FOR CATALOG

PALMER

PALMER THERMOMETERS, INC.
Cincinnati 12, Ohio • MElrose 1 1500

placement parts plus test and service facilities on the West Coast for Lawler's line of temperature blenders and controls . . .

WARREN WEBSTER & COMPANY, INC., Camden, N. J., announced the appointment of Maurice H. Hofmeister as sales representative in the Chicago, Ill., territory. . .

THE JAY R. SMITH MANUFACTURING COMPANY, Union, N. J., announced the appointment of Thomas J. Rueve, 5650 North Glen, Cincinnati 11, Ohio, as sales representative for the company's line of chair carriers, drains and engineered plumbing products in the Cincinnati territory. . .

THE S. J. O'BRIEN COMPANIES, New York City, has been appointed distributor for ARKLA AIR CONDITIONING CORP. domestic, commercial and industrial gas absorption air conditioning units, including the Sun Valley "All-Year" models, 25-ton water chiller-heaters and the Arkla-Humphrey line of gas heating equipment. . .

MODINE MANUFACTURING COMPANY announced plans to reorganize its New York sales territory as a prelude to providing increased customer service. Key step in the realignment, is the naming of R. S. (Shep) Doherty as sales representative for the territory. Mr. Doherty recently announced that he was resigning as vice-president of the A. W. Cash Valve Co., Decatur, Ill., to return to New York to open his own manufacturers' representation business. He plans to open an office at Mt. Kisco, N. Y.

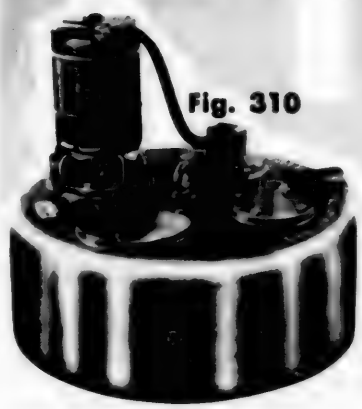
BURGEONING BUSINESS

A. M. BYERS COMPANY announced that they will market steel pipe on a national basis. Byers steel pipe is immediately available at competitive prices, and the company is prepared to handle orders in a wide range of sizes, finishes, and weights in A53 and A120 pipe grades. The company will market their steel pipe through its national sales force and present distributor network as

weil

LOW RETURN

CONDENSATE PUMP



10 GALLON RECEIVER
For single units. Diameter 21". Height of return above floor 6⅞".

15 GALLON RECEIVER
For single or duplex units. Diameter 25½". Height of return above floor 7¾".

26 GALLON RECEIVER
For single or duplex units. Diameter 25½". Height of return above floor 10½".

- LOW RETURN CONNECTION
- LOW SPEED, 1750 R.P.M.
- CAST IRON RECEIVER
- LOW WATER LINE
- Capacities to 15,000 sq. ft. EDR, pressures 10 to 40 lbs.

SELECTION TABLE

UNIT NO.	SQ. FT. E.D.R.	CAP. G.P.M.	H. P.	PUMP DISCH.	HEIGHT OF RETURN	RETURN INLET
TVC 19	750	1.5	¼	1"	6⅞"	2"
TVC 23	1000	1.5	¼	1"	6⅞"	2"
TVC 29	2000	3.0	¼	1"	6⅞"	2"
TVC 35	4000	6.0	¼	1"	6⅞"	2"
TVC 41	6000	9.0	½	1"	6⅞"	2"

DISCHARGE PRESSURE: 20 LBS. DIAMETER OF RECEIVER 21"; CAPACITY 10 GAL. FOR COMPLETE SELECTION TABLE SEE BULLETIN TVC-300.

This compact receiver and sturdy pumping unit with its low return connection and 1750 RPM motor is economical to install and guarantees a long, trouble-free life. Single units in 15 or 26 gallon receivers can be converted to duplex units at any time when load increases. Additional pump is installed on the job.

SEND FOR BULLETIN TVC-300.
STOCKED BY YOUR JOBBER

weil PUMP COMPANY
1516 N. FREMONT ST.
CHICAGO 22, ILLINOIS

well as new distributors appointed to handle Byers steel pipe. . .

WORTHINGTON CORPORATION announced a major expansion of its production facilities at the company's air conditioning plant in Decatur, Ala. Construction was expected to begin in November on a 90,000-sq ft extension which will increase the size of the existing 170,000-sq ft facility by over 50%. The new extension is scheduled for completion by 1961. According to Worthington, ever-increasing penetration into world-wide air conditioning markets as well as the rapid expansion of product line have been important contributing factors to the new addition. . .

Shareholders of IMPERIAL BRASS MANUFACTURING COMPANY of Niles, Ill., and EASTMAN MANUFACTURING COMPANY of Manitowoc, Wis., have approved merger of the two companies. Imperial, founded in 1905, is a manufacturer of tube fittings and valves, service and repair parts and tools for the industrial, automotive, refrigeration, plumbing, heating, air conditioning and original equipment fields. It is said to be the world's largest manufacturer of tubing tools. Eastman, founded in 1914, is particularly well-known for development and production of flexible and rigid hydraulic lines and fittings.

Working behind the scenes to keep the Air Moving Industry moving forward

AIR MOVING & CONDITIONING ASSOCIATION INC. AMCA

AMCA announces . . .

a New Standard Code

FOR TESTING THE PERFORMANCE OF ALL AIR MOVING DEVICES

BULLETIN 210

AMCA's new Bulletin 210 supersedes Bulletin 110 which has long served as the industry standard for testing and rating commercial and industrial fans. Incorporating the latest methods for testing all air moving devices, this new, broader and improved code represents many years of intensive study and comparative testing in cooperation with leading research organizations.

Send today for your copy.

Please send Bulletin 210
(Single copies free. A nominal charge is made on quantity shipments.)

Name _____

Company _____

Address _____

City _____ Zone _____ State _____

AIR MOVING AND CONDITIONING ASSOCIATION, INC.
2159 Guardian Building Detroit 26, Michigan

RECENT APPOINTMENTS

SPORLAN VALVE COMPANY announces the transfer of Peter H. Weir from its home office to Minneapolis. He will replace Malcolm Moore who resigned to take a position with the U. S. Patent Office in Washington, D. C. . .

James F. Donnelly, Jr. has been appointed to the position of manager of advertising and sales promotion for the Permaglas division of A. O. Smith Corporation, Kankakee, Illinois. His promotion is part of a stepped up marketing program necessitated by the number and diversity of products manufactured by the division . . .

Appointment of James A. Wheeler as product manager, air conditioning department, air side, has been announced by AMERICAN-STANDARD INDUSTRIAL DIVISION, Detroit, Mich. A mechanical engineering graduate of the University of Florida, Mr. Wheeler brings to his new job a background of 26 years in the air conditioning field . . .

RESEARCH PRODUCTS CORPORATION, Madison, Wis., announced the addition of Elwood Hughes to its sales staff in the capacity of district salesman. He will serve the territory of Western Pennsylvania and West Virginia, working in cooperation with B. L. Rushton Inc., Pittsburgh . . .

Allen W. Sherman has been elected vice-president of CARRIER CORPORATION, Syracuse, N. Y., and will head its personnel division. He succeeds Howard M. Dirks who has resigned to become vice-president, personnel and corporate relations, of Harris-Intertype Corporation, Cleveland, Ohio.

Consulting Engineers Council

(Concluded from page 95)

able funds, it may involve securing the support of the American Standards Association and its supporting groups.

Free Engineering

At a meeting of the CEC-Producers Council, the matter of free engineering was discussed at length. The following statements were adopted to be presented to the Executive Committees of both councils:

1. Producers should establish design guidance and application specifications for their products or systems, as normal procedure without charge.
2. Designers, including architects and consulting engineers, should undertake design responsibilities for professional fees.
3. When designers or owners ask producers to provide design services beyond normal, the producers should be properly compensated for engineering services rendered.
4. Architects, engineers, producers and contractors should join in publishing and publicizing the importance of employing competent design talents at proper compensation for skills involved.

While a number of other matters came to the attention of this meeting, the problem of the package deal was considered very important. CEC would like to see the separation of engineering and construction services which are now available from some companies as a package deal.

Canadian Degree-Days for September and October, 1960*

City	September		October	
	1960	Normal	1960	Normal
Calgary, Alta.	381	410	636	710
Charlottetown, P. E. I.	237	240	624	550
Crescent Valley, B. C.	375	330	667	680
Edmonton, Alta.	386	440	686	750
Fort William, Ont.	366	370	705	740
Grande Prairie, Alta.	417	450	748	800
Halifax, N. S.	151	190	498	469
London, Ont.	123	150	513	490
Medicine Hat, Alta.	238	300	545	600
Moncton, N. B.	267	260	661	590
Montreal, P. Q.	176	190	546	550
North Bay, Ont.	311	320	652	670
Ottawa, Ont.	197	200	561	580
Penticton, B. C.	272	200	478	520
Prince George, B. C.	524	460	691	750
Quebec City, P. Q.	288	290	670	650
Regina, Sask.	287	370	717	750
St. John, N. B.	278	280	634	590
Saskatoon, Sask.	300	380	717	760
Timmins, Ont.	427	410	772	780
Toronto, Ont.	71	154	426	465
Vancouver, B. C.	254	220	411	440
Victoria, B. C.	281	230	429	410
Windsor, Ont.	67	120	387	410
Winnipeg, Man.	279	311	642	686

* These data are supplied through the courtesy of the Meteorological Branch, Air Service, Department of Transport, Canada.

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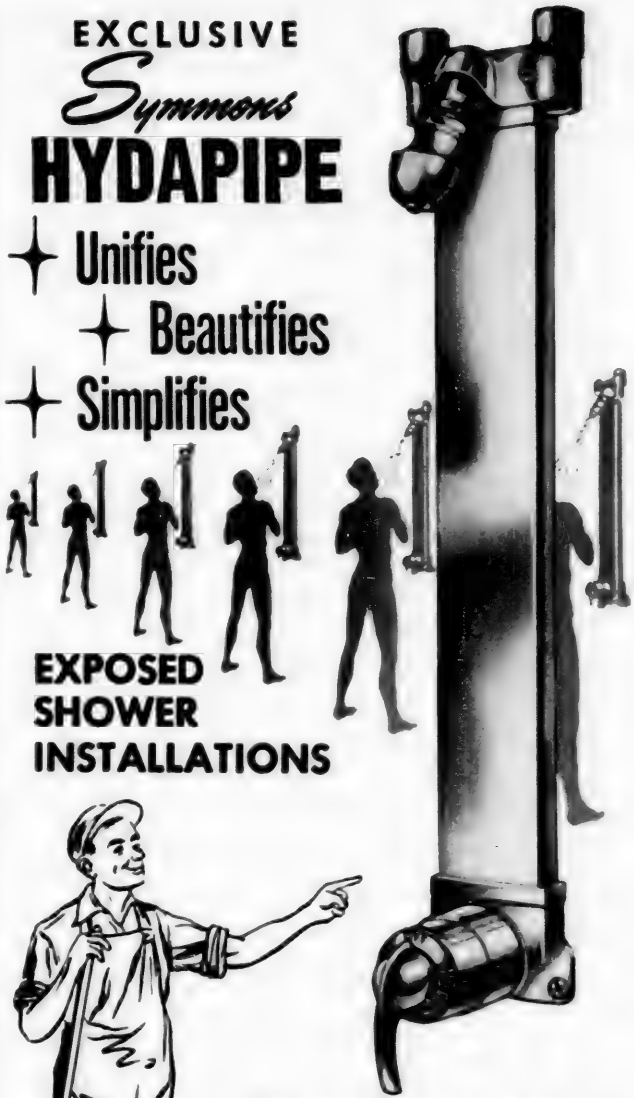
HYDAPIPE

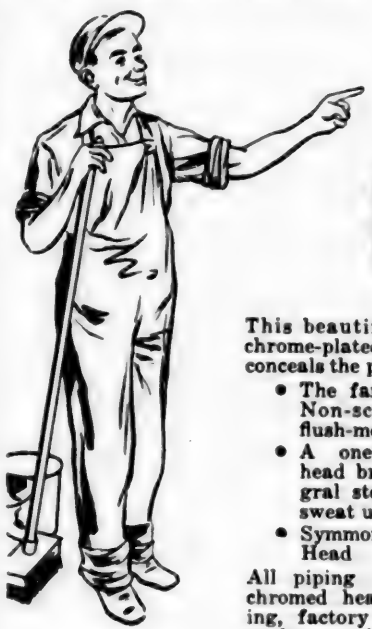
✦ Unifies

✦ Beautifies

✦ Simplifies



EXPOSED SHOWER INSTALLATIONS



Ask now for Hydapipe bulletin.

This beautiful, one-piece brass, chrome-plated unit encloses and conceals the piping. It includes:

- The famous SAFETY MIX, Non-scald Shower Valve, flush-mounted
- A one-piece, flush-mounted head bracket unit with integral stops, and ½" I.P.S. or sweat union connections
- Symmons "Senior" Shower Head

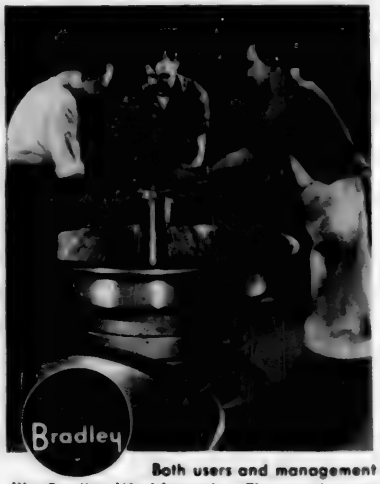
All piping is enclosed in fully-chromed heavy gauge brass casing, factory assembled, ready to anchor to the wall. It is easy to install. Connection of hot and cold supplies is all that is needed with Hydapipe. Minimum maintenance and housekeeping is required.

See SWEET'S ARCHITECTURAL FILE, DOMESTIC ENGINEERING CATALOG or write us direct for further information

Symmons ENGINEERING COMPANY

Dept. 2-C 445 C STREET, BOSTON 10, MASSACHUSETTS

BRADLEY FOOT CONTROL
ELIMINATES FAUCETS—LEAVES BOTH HANDS FREE TO WASH AND RINSE



Wash Many Hands Fast
•
Replaces 8 Ordinary Basins
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Requires only one set of Piping Connections
•
Use Your Foot to Wash Your Hands

Both users and management like Bradley Washfountains. They wash more hands cleaner, faster and more conveniently—and save on first cost, installation, maintenance, janitor labor and water consumption. Investigate today. There is a Bradley Washfountain designed to meet your requirements.

BRADLEY WASHFOUNTAIN CO.
2352 West Michigan Street
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WRITE FOR NEW CATALOG 6004

PROVED ON THOUSANDS OF PRODUCTION LINE INSTALLATIONS!

"250" SERIES
LIQUID EYE
POSITIVE SEALING INDICATORS
Designed to save you both time and money

DESIGN FEATURE
extension-gasket . . . ALL ONE-PIECE!
A built-in gasket that's always in place for positive sealing and foolproof assembly.

6 sizes now available: ⅜", ½", ⅝", ¾", 1⅛" and 1⅝" O.D.S.

The "250" has all the proved Liquid Eye advantages *plus* these newly engineered features:
- smaller—more compact, simplified design.
- preformed copper extension eliminates need for separate gaskets—*foolproof* installation.
- complete, self-contained, economy unit.

Write today for catalog E-57 covering the complete Allin line.

Allin
ALLIN MANUFACTURING CO.
410 N. Hermitage Ave. • Chicago 22, Illinois
Over 1,000,000 Liquid [illegible]

BOOK REVIEWS

Publications abstracted in this department should be ordered direct from publisher.

ROOM HEATING UNITS COMPARED—It appears that there are no significant differences in heat requirements among variously shaped cast iron radiators, front-outlet convectors, or baseboard when these (hot water) units are operated under normal usage conditions with thermostatic control.

"It may be concluded," say Warren S. Harris and L. N. Montgomery, "that fuel consumption is more dependent on the location of the heating unit in the room and the method of operation than on the design of the heating unit itself."

A Comparison of the Performance of Various Room Heating Units Used in the I-B-R Research Home is a report of an investigation conducted by the Engineering Experiment Station of the University of Illinois in cooperation with The Institute of Boiler and Radiator Manufacturers. Mr. Harris is research professor of mechanical engineering. Mr. Montgomery is a former Research Associate in mechanical engineering.

Minor differences in floor-to-ceiling room-air temperatures, first and second story air temperatures, mean radiant temperatures, wall surface temperatures, and cyclic air temperature variations are reported for different units, but none of sufficient magnitude to have a significant bearing on the comfort conditions in the (I-B-R Research) home. University of Illinois Circular, Volume 57, Number 46, University of Illinois, Urbana, Ill. Price is fifty cents.

CIVILIAN POWER REACTOR PROGRAM—Book 2, Part III, Status Report on Pressurized Water Reactors as of 1959, TID-8518 (2), has been published by the Atomic Energy Commission, part of an 11-volume report on the Civilian Power Reactor Program. Book 2 has 86 pages of text, 32 excellent illustrations, and five tables discussing various pressurized water reactors in operation, being built, or planned. The volume summarizes the pressurized water reactor concept, the objectives of the program for this concept, the related general research and development program, the experience that has been gained with operating reactors, construction and operation schedules, present limitations and problems with regard to the concept and a bibliography on pressurized water reactors. Also included is a reactor data table and cross-section drawings of 10 reactors. The volume is available from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C., and costs $1.25.

AIR POLLUTION AND SMOG—A general discussion of air pollution, smog and California's attack on auto exhaust. It also contains a table which gives the California standards for ambient air quality. This is intended to supply information which could be used to answer some of the common questions regarding air pollution and smog and controls. Air Pollution Foundations, 2556 Mission St., San Marino, Calif.

BRI PUBLICATIONS—Two publications are available, based on conferences that were part of the 1959 Fall Conference of the Building Research Institute. Publication 782 on The Current Status of Modular Coordination contains four papers that were presented on this subject, plus the discussions of these papers. Price, $2.50. Publication 788 on The Design Potential of Metal Curtain Walls is divided into two parts. The first covers case studies of five buildings, each from a different architectural firm, plus related discussion. Part two covers a number of papers dealing with design of metal curtain walls and discussions of the papers. Price, $5. For copies of these publications, write to Building Research Institute, 2101 Constitution Ave. N.W., Washington 25, D. C.

CAST IRON PIPE FLANGES AND FLANGED FITTINGS—Two standards for cast iron pipe flanges and flanged fittings have been published by the American Society of Mechanical Engineers with ASME, Mechanical Contractors Association of America, and Manufacturers Standardization Society of the Valve and Fittings Industry as sponsors. Class 125 is covered in ASA B16.1-1960 and Class 250 in ASA B16.2-1960. These standards cover dimensions and tolerances, pressure ratings, markings, bolt, nut and gasket designations, and tests. American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y. Price for each standard, $1.50.

REFRIGERATED STORAGE INSTALLATIONS—A group of engineers from major government agencies has prepared Refrigerated Storage Installations, a technical report which covers design criteria and selection procedures. Results of an analysis of 44 installations in this country are reported. Data are included on vapor barriers, insulations and installation. It is publication number 759 and may be ordered from Printing and Publishing Office, National Academy of Sciences—National Research Council, 2101 Constitution Ave., Washington 25, D. C. Price, $2.

PAINTS AND COATINGS—Papers and panel discussions that were part of a 1960 BRI Spring Conference are presented as Publication 796. Several papers were presented on each of the following topics: Field preparation of surfaces; field application methods; water thinned paints and coatings. Building Research Institute, 2101 Constitution Ave. N. W., Washington 25, D. C. Price, $5.

ADDITIONS TO THE AIHA GUIDE SERIES—Five new guides have been added to the series published by the American Industrial Hygiene Association. They are entitled Acetronitrile, Diethylamine, Diethylene Triamine Nitropropane, and Tetrachlorethylene. Each guide is devoted to one substance and covers such topics as potential hazards, industrial hygiene control practices, and specific medical procedures for treatment of persons over-exposed to the substance. Price, 25 cents each. American Industrial Hygiene Association, 14125 Prevost, Detroit 27, Mich.

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COMING EVENTS

Where listed, names or titles of individuals are those from whom further information is available.

INDUSTRIAL BUILDING EXPOSITION—Industrial Building Exposition and Congress at the New York Coliseum, New York, N. Y. Clapp & Poliak, Management, 341 Madison Avenue, New York 17, N. Y. ..... **DECEMBER 12-15, 1960.**

EXPOSITION OF AUTOMOTIVE ENGINEERING—International Congress and Exposition of Automotive Engineering, sponsored by the Society of Automotive Engineers, Inc., at Cobo Hall, Detroit Mich. J. Gilbert, secretary of the Society, 485 Lexington Ave., New York 17, N. Y. ..... **JANUARY 9-13, 1961.**

INSTRUMENT-AUTOMATION CONFERENCE—ISA Winter Instrument-Automation conference and exhibit, at Kiel Auditorium St. Louis, Mo. Wm. H. Kushnick, executive director of the Instrument Society of America, 313 Sixth Ave., Pittsburgh 22 Pa. **JANUARY 17-19, 1961.**

PLANT MAINTENANCE CONFERENCE—1961 Plant Maintenance & Engineering Conference at the International Amphitheatre, Chicago, Ill. Clapp & Poliak, Inc., 341 Madison Ave., New York 17 N. Y. ..... **JANUARY 23-26, 1961.**

HYDRONICS HEATING SHORT COURSE—13th annual Short Course on Hydronic Heating and Cooling, at the University of Illinois, under the joint sponsorship of the University and The Institute of Boiler & Radiator Manufacturers. W. K. Newton, Supervisor of Engineering Extension, 116D Illini Hall, Champaign, Ill. **JANUARY 30-FEBRUARY 2, 1961.**

ASHRAE MEETING—Semi-annual meeting of the American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., at the Conrad Hilton Hotel, Chicago, Ill. Secretary, Robert C. Cross 234 Fifth Ave., New York 1, N. Y. ..... **FEBRUARY 13-16, 1961.**

HEATING AND AIR CONDITIONING EXPOSITION — International Heating and Air Conditioning Exposition, at the International Amphitheater, Chicago, Ill. E. K. Stevens, International Exposition Co., 480 Lexington Ave., New York 17, N. Y. ..... **FEBRUARY 13-16, 1961.**

NATIONAL SYMPOSIUM ON TEMPERATURE—Third National Symposium on Temperature—Its Measurement and Control in Science and Industry, sponsored jointly by the American Institute of Physics, Instrument Society of America, and the National Bureau of Standards, to be held in Columbus, Ohio. C. L. Roberson, ISA, 313 Sixth Ave., Pittsburgh 22, Pa. ..... **MARCH 27-31, 1961.**

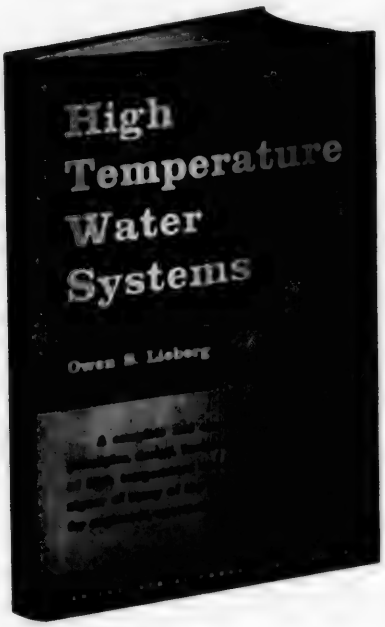
CORROSION ENGINEERS CONFERENCE—Annual Conference and Corrosion Show of the National Association of Corrosion Engineers, at the Statler Hotel Buffalo, N. Y. T. Hull, executive secretary of the Association, 1061 M&M Building, Houston 2, Tex. **APRIL 5-7, 1961.**

INDUSTRIAL HYGIENCE CONFERENCE—Annual American Industrial Hygiene Conference at the Sheraton-Cadillac Hotel, Detroit, Mich. Publicity chairman, J. D. MacEwen, Wayne State University, 1401 Rivard St., Detroit 7, Mich. ... **APRIL 9-13, 1961.**

CONVENTION ON WELDING—Annual convention of the American Welding Society, The Coliseum, New York, N. Y. For information write, American Welding Society, 33 W. 39th St., New York 18, N. Y. ..... **APRIL 18-20, 1961.**

CONSULTING ENGINEERS COUNCIL—Annual meeting of the Board of Directors of Consulting Engineers Council, at Executive House, Chicago, Ill. Executive Secretary, L. N. Spiller 326 Reisch Bldg., Springfield, Ill. ..... **MAY 4-6, 1961.**

NDHA MEETING—Annual meeting of the National District Heating Association, Wentworth-by-the-Sea, Portsmouth, N. H. Secretary, John F. Collins, Jr., 827 N. Euclid Ave., Pittsburgh 6, Pa. ..... **JUNE 12-15, 1961.**



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SELF-FLASHING CURB .....
from Penn Ventilator provides three important benefits to the design engineer-in roof ventilator installations. Company provides one source for curb, damper and ventilator. Information is offered.
Inside Front Cover Item 200

STEAM TRAP BOOK .....
available from Armstrong goes into great detail in its 44 pages, answering such questions as, "How much steam should a steam trap trap?". Also discusses trap selection, installation, and maintenance.
Page 1 Item 201

NEW CONDENSATE PUMP BULLETIN ..
describes type UV units made by Skidmore, which are built in both single and duplex models. Can be installed with cover plate flush with floor. Motor and float switches easily accessible above floor level and out of danger.
Page 2 Item 202

SMOKE STACKS .....
become true chimneys when you specify installation of a Field draft control. Units provide draft precisely controlled to the needs of gas combustion. Information is available.
Page 5 Item 203

SMOOTH FIN COIL DESIGN .....
of Aerofin Corporation permits use of high air velocities without turbulence or excessive resistance and provides ample heat-exchange capacity in limited space. You can safely specify at full published ratings. Aerofin coils sold by manufacturers of fan system apparatus, list available.
Page 7 Item 204

STEAM TRAPS .....
made by Hoffman are part of a complete line of specialties for steam and water. Inverted bucket traps feature stainless steel interiors, straight-through pipe connections with various sized pins and seats for a wide range of pressures. F&T traps give continuous drainage, are quickly and easily serviced with no need to break pipe connections. Information available.
Page 9 Item 205

DUAL DUCT UNITS .....
Produced by Buensod-Stacey afford complete conditioning through all seasons of the year. Proper conditions maintained in every space. Patented automatic volume-controlled mixing units provide constant air volume-in every zone, regardless of variants in static pressures. Bulletin available.
Page 11 Item 206

BOILER SAFETY CONTROLS .....
are neatly described in booklet, Basic Safety Controls, for hot water space heating boilers by McDonnell & Miller, which gives the what-why-how in eight interesting pages. Includes recommended piping hookups.
Page 13 Item 207

REFRIGERATION SPECIALTIES .....
are detailed in Sporlan catalog describing the first molded porous core filter dryer, the first combination moisture and liquid indicator, solenoid valves with layer wound coil. thermostatic expansion valves with the original FlowMaster element, and distributors with versatile interchangeable nozzles.
Page 15 Item 208

AIRTROL SYSTEM .....
made by B&G is guaranteed to end air troubles in forced hot water systems. Property management consultant testifies that installation eliminated all troubles due to poor heating from trapped air, will install them on 35 boilers heating large housing project. Information available.
Page 17 Item 209

ROOF-MOUNTED CONDITIONER .....
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Pages 18-19 Item 210

NEW WATER HEATER .....
manufactured only by Patterson-Kelley provides all the hot water required for domestic service, comfort heating, and air conditioning re-heat. It will not scale because heat transfer occcurs below the temperature at which minerals precipitate. Engineering data offered.
Page 20 Item 211

SHOCK ABSORBERS .....
by Josam protect pipe, fittings, and control devices from failure due to repeated shock from water hammer. Units eliminate water hammer completely and assure quiet, costing very little compared to the damage they prevent. Manual offered describes proper methods of sizing and where to locate.
Page 21 Item 212

EXTREMELY CLEAN AIR .....
filtered by Westinghouse Precipitation units provide the necessary atmosphere for precision electronic parts manufacturing. Booklet, describing the advanced air engineering concept, based on Westinghouse air handling and air cleaning products, available.
Page 22 Item 213

PRECISION COPPER TUBE .....
under the Mackenzie Walton label is produced by Reading for those who need a small, seamless tube for instrumentation, air conditioning, refrigeration, surgical instruments, automotive applications, and many others. Detailed catalog describes full line of small tubing.
Page 23 Item 214

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EXTRUDED ALUMINUM GRILLES ..... for floors, sills and walls are manufactured by Waterloo Register Co. They fit perfectly into modern architectural and engineering concepts. Selection guide is offered.
Page 24 Item 215

SILENT POWER ROOF VENTILATORS .. made by Ilg Electric Ventilating Co. are available in 11 sizes from 87 to 21,000 cfm. Direct-connected fan and motor eliminate belts and pulleys. Patented "Q" wheel dynamically balanced. Bulletin gives details.
Page 25 Item 216

CENTRAL CONDITIONING ..... with Thermal Engineering units, is being installed by an ever increasing number of banks because of the units' reputation for quality and dependability. Ready accessibility of internal components is combined with rugged construction. Complete catalog offered.
Page 26 Item 217

TYPE L COPPER TUBE ..... is available from Anaconda for air conditioning and refrigeration: cleaned, dried, capped, color-coded, and marked ACR, in 20-ft straight lengths, hard temper from ¼ to 6 inches. Also a broad range of soft temper from ⅛ to 1⅜ OD. Information available.
Page 27 Item 218

INDUSTRIAL AIR FILTER ..... made by Research Products is a multi-velocity device for heating and air conditioning. Of rust proof aluminum construction, its light weight makes it easy to handle, wash, and install. Depth loading through successive layers and varying baffle sizes. Revolutionary filter coat adhesive removes odors. Information available.
Page 28 Item 219

AIRFOIL BLADED FANS ..... from American-Standard Industrial Div. have an exclusive radial rim wheel design that substantially lowers air velocity through the blast area of the wheel. This reduces turbulence and results in unusually quiet fan operation. Bulletin is offered.
Page 29 Item 220

SOUND CONTROL CURB ..... for power exhausters made by Jenn-Air provide effective noise suppression plus high air delivery. One unit provides both. Sound power reduced 90% with only 10% loss in air moving capacity. Ratings confirmed by independent laboratory tests. Information available.
Page 30 Item 221

VALVES ..... bearing the Jenkins trademark are known by their performance over many years. The trademark has been respected by buyers and specifiers of valves because it is well known that since 1864 there has been no compromise in quality. Information available.
Page 31 Item 222

RESILIENT MOUNTED MOTORS ..... in ratings through 10 horsepower are manufactured by Wagner Electric Corp. These polyphase motors feature quiet, vibration-free performance. Information is available.
Page 32 Item 223

ZONE CONTROLLED CABINET ..... offered by Buffalo Forge provides year-round comfort conditioning to suit many different areas of a building. Each zone controlled automatically. Rugged tubular frame is easily assembled and installed. Floor or suspended mounting. Low head room due to 45 degree pitched coils. Bulletin available.
Page 33 Item 224

SWEAT-PROOF INSULATION ..... called Aerotube by Johns-Manville is a flexible foamed plastic pipe insulation that cuts installation costs in half. Has a built in vapor barrier. Recommended for heating, plumbing and air conditioning service. Brochure available.
Pages 34-35 Item 225

FLUSHING SYSTEM ..... from Sloan Valve Co. flushes urinals automatically. System eliminates user operation since it is actuated by a motor operator; flushing cycle is controlled by one of several available timers. Information is offered.
Page 36 Item 226

HIGH FUEL COSTS ARE CUT ..... by Cleaver-Brooks packaged boilers which provide a combination of fuel-saving design standards that are not found in any other boiler at any price: four-pass design, forced-draft combustion, updraft construction, and 5 sq ft of heat transfer surface per boiler horsepower. Compact units through 600 hp. Boiler-room templates designed for consulting engineers offered.
Page 37 Item 227

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Pages 38-39 Item 228

CAST IRON GAS BOILER ..... (Type J) made by Weil-McLain does not need a high chimney, nor is a draft fan necessary. Conforming to AGA venting requirements, its products of combustion can be expelled with only a 5-ft. vent riser beyond the draft hood openings. Bulletin available.
Page 40 Item 229

INDUSTRIAL WATER CHILLING ..... can be had at low cost with a Trane hermetic absorption Cold Generator. Advanced hermetic design and single shell construction provide simplified installation, minimum maintenance, and economical operation for process or comfort cooling. Units from 100 to 530 tons. Fully automatic operation means no full-time attendant needed. Information available.
Pages 42-43 Item 230

ANY STEAM REQUIREMENT ..... can be supplied with a B&W boiler whatever the fuel. Many hospitals use these boilers because of their dependability for supplying clean, dry steam. Low maintenance, cleanliness of operation, high operating economies, rapid response to demand, and maximum capacity in minimum space are other features. Information available.
Page 45 Item 231

The items appear in the same order as the advertisements to which they refer, to facilitate obtaining further information after reading an advertisement. All advertisements are digested here except those that are received too late for inclusion in this listing.

Ad-Digest

INQUIRY SERVICE FOR ADVERTISED PRODUCTS

HIGH VELOCITY AIR EQUIPMENT .... produced by Barber-Colman is being used in ever increasing quantities. Company's research, testing and development work on high velocity systems for over ten years has resulted in a wealth of valuable data plus important new high velocity air distribution products. 52-page High Velocity Data File offered.
Pages 46-47 **Item 232**

BEST ROOF DRAIN MADE ..... is a product of Wade, which boasts that, in fact, it has no equal. Ad compares company's model with two other makes, showing its unit more generously sized, heavier, and more ruggedly joined. Information available.
Page 49 **Item 233**

COOLING TOWERS ..... by Halstead & Mitchell cut costs by packaging. These 150-ton packages are used together in any multiple for inexpensive installation and lowered operating costs because of step-control. Twenty-year guarantee on wetted deck against failure dug to fungus or rotting. Information available.
Page 105 **Item 234**

IN-DUCT FAN ..... made by DeBothezat is now so constructed that you can pull the fan wheel or motor while the Bifurcator fan remains in the duct. It speeds up inspection and slashes maintenance and downtime costs. Literature available.
Page 107 **Item 235**

CUSTOM-BUILT PUMPS STOCKED .... by Taco. By specifying any standard Taco LP pump, with it many options, you can actually order a custom-designed single stage centrifugal pump to meet your requirements, precisely. Information available.
Page 109 **Item 236**

FORCED DRAFT BURNER ..... made by Iron Fireman (WhirlBlast) for gas, oil, or dual fuel, saves construction costs because no stack, pit, or brick are needed; causes no flame pulsation; burns clean; and is packaged for easy installation and servicing. Full information available.
Page 111 **Item 237**

GAS-OPERATED CONDITIONING ..... made by Ready-Power achieves the lowest known operating costs. Natural gas engine-driven compressor units, condensing units, or matched chiller-condenser are packaged systems in capacities from 20 to 110 tons. Total operating costs come to less than one cent per ton per hour. Information available.
Page 113 **Item 238**

LINE TAP VALVES ..... from Watsco Inc. provide a positive sealed port at low cost, and will test, charge, and discharge a system in minutes. Information is offered.
Page 115 **Item 239**

FLAME-RESISTANT DUCT TAPE ..... by Arno complies with all building codes, is self-adhesive, will not support flame. There is nothing to mix, so saves labor. It is vapor proof, water proof, and meets ASTM standards. Free test sample offered.
Page 115 **Item 240**

PRESSURE BURNERS ..... for dual-fuel, gas, or oil are offered by Synchronous Flame. Designed for hard-to-fire jobs; all types of boilers, warm air furnaces, and ovens. Many standard features which are extras on other burners. Detailed information offered.
Page 117 **Item 241**

DIFFUSER CATALOG ..... offered by Air Devices describe the original square and rectangular diffusers, tradenamed AgiTaiR, with jet induction diffusing vanes. More than 1,000,000 are in use today, custom-made with louver arrangements for 1- 2- 3- or 4-way proportional blows.
Page 117 **Item 242**

SPRAY NOZZLES ..... and all related accessories for humidifying are available from Spraying Systems Co. For industrial installations of every size. Everything but the piping, wiring and compressor. Bulletin is available.
Page 117 **Item 243**

ROOF VENTILATORS ..... in 12 different types are illustrated in this month's ad by Western Engineering & Mfg. Co. Information on these ventilators is available.
Page 118 **Item 244**

ALNOR PYROCON ..... permits you to set thermal expansion valve of air conditioning system in less than a minute. It eliminates the slow thermometer method of determining temperatures in the system. Recommended Model 4000 has temperature range of 0-300 deg. F. Bulletin available.
Page 119 **Item 245**

VACUUM THERMOSTAT ..... made by Sterling, Inc., is simple and trouble-free, assuring efficient economical steam trap operation. Thermostat compensates for pressure changes. While vacuum in thermostat remains intact, traps require no attention other than normal maintenance. If vacuum is lost, thermostat closes trap and radiator. Bulletin available.
Page 120 **Item 246**

ELECTRIC RADIANT HEATERS ..... called Infra-Mite by Apextro are new units for controlled-area spot heating. Infra-red emitter, with fused quartz element gives instant warmth. Compact and highly decorative. For comfort or heat-processing operations. Mounts on ceiling or wall. Information available.
Page 121 **Item 247**

ECONOMICAL CONDENSERS ..... from Niagara Blower Co. are lower in first cost and bring greater returns in power savings, water savings, and reduced maintenance expense. Two bulletins are offered.
Page 122 **Item 248**

Ad-Digest

INQUIRY SERVICE FOR ADVERTISED PRODUCTS

Use this Digest to locate and refer to the advertisements in which you are particularly interested, then fill out and mail a prepaid postcard, either of two that appear on the yellow page following, to request further information from manufacturers.

FLEXIBLE HOSE .....
made by Flexaust of high quality metal and neoprene coated fabrics has proven lower in installation costs and provides exceptional abrasion resistance, noise absorption and easy relocation of hoods and machines. Full details available.
Page 122 Item 249

CLOSE-COUPLED CENTRIFUGALS ....
called Centri-Pac pumps by Aurora are now available in 11 packaged sizes in capacities to 400 gpm and heads to 150 ft, for low pumping costs on air conditioning equipment, circulating services and general services. Extremely compact, highly efficient, smooth and quiet in operation. Bulletin gives details.
Page 123 Item 250

QUALITY R&AC EQUIPMENT .....
made by Vilter finds wide application in industrial installations (meat packing, dairies, breweries, etc.) and air conditioning systems in banks, hospitals, etc. Bulletins cover chillers for air conditioning and rotary compressors for refrigeration applications.
Page 124 Item 251

INDUCED DRAFT FANS .....
made by Lehigh are designed to eliminate large, costly, unsightly stacks. They maintain a constant over-fire draft regardless of atmospheric conditions, help keep boilers operating at maximum efficiency, and lower fuel bills. Detailed technical bulletin explains.
Page 125 Item 252

INSTRUMENT MANUAL .....
is offered to all users of gages and controls by F. W. Dwyer Mfg. Co. The 72-page manual includes engineering data and product descriptions.
Page 126 Item 253

DIRECT-FIRED DUCT FURNACES .....
made by Reznor cut central heating costs by avoiding the expense of boilers, piping, and controls, cutting installation time and costs. May be used singly or in capacities up to 300,000 Btuh. Catalog available.
Page 127 Item 254

FOUR DIFFERENT THERMOMETERS ...
are described in Palmer ad: 4½-inch dial thermometer (stem can be placed at any angle, case can be rotated); recording thermometers with ranges from minus 40 to plus 950 deg C; industrial thermometers; and red-reading mercury laboratory thermometers. Catalog available.
Page 128 Item 255

SCAFFOLDS .....
by Baker permit you to work faster. Bulletin explains how they can be used in single units and in many combinations. Portable and durable design.
Page 128 Item 256

CONDENSATE PUMP BULLETIN .....
offered by Weil Pump describes a compact receiver and sturdy pumping unit with low return connection and 1750 rpm motor which is economical to install and guarantees long, trouble-free life.
Page 129 Item 257

NEW STANDARD CODE .....
for testing the performance of all air moving devices announced by Air Moving and Conditioning Association (AMCA). It supersedes Bulletin 110 which has long served as the industry's standard for testing and rating commercial and industrial fans. Copies are free.
Page 130 Item 258

NON-SCALD SHOWER VALVE .....
from Symmons Engineering Co. is part of Hydapipe system for exposed shower installations. System simplifies and beautifies. Literature is available.
Page 131 Item 259

POSITIVE SEALING INDICATORS .....
made by Allin Mfg. Co. proven on thousands of production line installations have one piece extension gasket for positive sealing and fool-proof assembly. Six sizes. Complete line catalog available.
Page 132 Item 260

NEW WASHFOUNTAIN CATALOG ....
describes the Bradley foot control which eliminates faucets and leaves both hands free to wash and rinse. Units permit many hands to be washed fast, replace eight ordinary basins and require only one set of piping connections.
Page 132 Item 261

POWER-DRAFT UNITS .....
designed for residential commercial and industrial applications are offered by Quickdraft Corp. They provide maximum heating or exhausting efficiency at lowest cost. Engineering data bulletin is available.
Page 133 Item 262

FLOATS .....
for any liquid level control problem are available from Arthur Harris & Co. They meet requirements of high temperature, high pressure, or highly corrosive service. Catalog is offered.
Page 134 Item 263

AIR FILTER INSTITUTE .....
lists its members, from whom you can buy air filters with confidence. Information available.
Page 134 Item 264

THE ONLY FLEXIBLE DUCT .....
of flat metal spiral construction that accepts self drilling-tapping screws is made by WiremoID. Two or three screws keep duct securely in place. Installation data offered.
Page 135 Item 265

FOR MECHANICAL DRAFT SERVICE ...
don't choose less than Clarage quality. With anything as vital as uninterrupted operation, it pays big dividends to get the best in equipment. Information is available.
Inside Back Cover Item 266

PILOT POSITIONER .....
for two-stage operation of unit ventilator damper operators, the Johnson D-267 double range model, is specially designed for schoolroom unit ventilators to meet minimum outdoor air requirements. Bulletin explains details of first and second stage operation and how unit assures precise control.
Back Cover Item 267

Advertisements in this issue are summarized on the Ad-Digest pages preceding this page. If you want more information on advertised products, locate the Digest item number of that advertisement, circle the item number on either of the post-cards provided below.

Use the post-cards below

to obtain catalogs mentioned in this issue or further information on products described or advertised in this issue.

1. Circle item numbers of new equipment and catalog descriptions
2. Circle item numbers of advertisements as shown in the Ad-Digest on the preceding pages
3. Mail . . . we'll do the rest

CIRCLE FOR NEW EQUIPMENT AND LITERATURE INQUIRIES

1	2	3	4	5	6	7	8	9	10	11	12
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December '60

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Permit No. 53
New York, N. Y.

BUSINESS REPLY MAIL
No Postage Stamp Necessary if Mailed in the United States

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Air Conditioning, Heating and Ventilating
93 WORTH STREET
NEW YORK 13, N. Y.

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to obtain catalogs mentioned in this issue or further information on products described or advertised in this issue. See preceding page for instructions.

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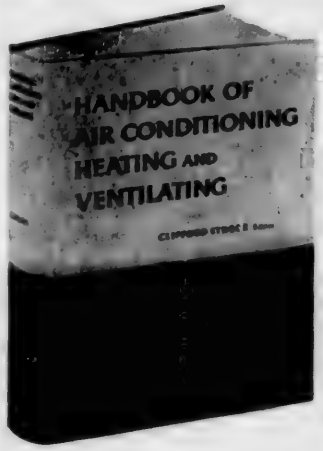
BOOKS LIKE THESE ARE RELIABLE TOOLS THAT CAN HELP YOU IN YOUR WORK!



HANDBOOK OF AIR CONDITIONING, HEATING AND VENTILATING

Edited by Clifford Strock

Completely new book containing thousands of facts, figures, data and principles; hundreds of charts, tables and maps. Answers problems you face every day in your work. Subjects treated thoroughly include: Air Conditioning, Air Handling, Building Heat Loss, Climatic Data, Combustion, Degree-Days, Dual Duct Design, Dust Collection, Fuel Estimating, High Velocity Air, Mathematics, Motors, Piping and Plumbing, Psychrometry, Radiator Heating, Refrigerants, Service Hot Water, Solar Data, Steam Flow, Ventilation, Warm Air Heating, Terminology. Completely cross-indexed. **1094 Pages, 7⅜" x 10¾", 598 Charts, Maps, Illus., 518 Tables, $15.00.**

PIPEFITTERS HANDBOOK

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by Forrest R. Lindsey

Written by a pipefitter for pipefitters. Covers: Pipe Bending — Screwed Offsets — Mitered Joints — Dimensions—Screwed Fittings — Butt Welding Fittings — Flanges and Flanged Fittings—Solder Joint Fittings—U-Bolts—Spacing of Hangers—Water in Pipes—Pipe Expansion—Identification—Contents of Tanks — Valves — Plastic Pipe — Metals — Steam — Mathematical Data—Measures—Conversion Tables—Trigonometry—Field Layout of Angles —Dictionary. **416 Pages, 248 Illustrations, $6.00.**

DESIGN OF AIR CONDITIONING SYSTEMS

by F. W. Hutchinson

115 full-page charts solve problems of air conditioning system design involving cooling load, duct design, psychrometrics, solar energy, comfort conditioning, panel cooling, etc. For each chart the engineering and mathematical background plus design example and solution are given. **336 Pages, 118 Illus., $7.00.**

DESIGN OF HEATING AND VENTILATING SYSTEMS

by F. W. Hutchinson

96 full-page charts solve problems of heating and ventilating involving load determination, duct design, panel heating, solar heating and combustion analysis. Companion book to Design of Air Conditioning Systems. Same methods to explain and solve problems are used. **320 Pages, 96 Charts, $7.00.**

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SUMMER AIR CONDITIONING

by S. Konzo, J. R. Carroll and H. D. Bareither

Training text and reference book on residential air conditioning. Covers: Comfort Conditions — Summer Weather—The Sun in Relation to the House—Methods of Cooling—The Compressor System in Packaged Form —Fans—Duct Systems—Distributing Air in Rooms—Noise Control—Heat Gain in Houses—Designing Air-Duct Systems and Selecting Equipment—Operating Cooling Equipment — The Air-Conditioning Industry. **560 Pages, 266 Illustrations, $8.00.**

WINTER AIR CONDITIONING

by S. Konzo, J. R. Carroll and H. D. Bareither

Does for hydronic and warm air heating what *Summer Air Conditioning* does for cooling. Covers: Temperature, Humidity, Wind, Sun—Heat Transfer and Comfort Standards—Reading and Drawing Heating Plans—House Construction—Calculating Heat Losses—Heat Generation—Boilers and Furnaces—Radiators and Convectors—Steam Heating—Hot-Water Heating —Warm-Air Heating—Modulated Heat Delivery—Trends and Developments in Heating. **640 Pages, 300 Illustrations, $8.00.**

COMBINATION OFFER

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FIRST CLASS
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BOOK DEPT.

PUT THE FACTS AND FIGURES YOU NEED AT YOU FINGER TIPS—WITH BOOKS!

HIGH TEMPERATURE WATER SYSTEMS

by Owen S. Lieberg

A complete and concise exposition of the principles, design, installation and application of high temperature water. Written by the designer of many of the world's largest systems. For engineers, operators, and owners. **224 Pages, 109 Illus., $6.50.**

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How to locate and correct faults in circuits of all kinds—controllers, motors, transformers and transmisison lines. Field tested procedures. An ideal training and reference book. **200 pages, 100 Illus., $5.00.**

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Design factors and data that can be applied to any situation. Principles are clear, logical. Shows how to estimate exhaust requirements for dust and fume producing processes, hot or cold. Principles of general ventilation and bulk materials handling. **448 Pages, 172 Illus., $9.00.**

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Properties, selection, storage, handling, and burning of all grades of fuel oil. How to assure uniform quality, efficient combustion, maximum value. Additives, treatments, troubles and remedies. **176 pages, 34 tables, $4.50.**

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Fuel Engineer, The Dayton Power and Light Company, Dayton, Ohio

An exceptionally comprehensive treatment of the subject, including methods and equipment, piping, flues, corrosion and fuel cost comparisons, with special emphasis on estimating data for all types of applications presented in 65 tables, 17 graphs and 13 sketches.

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by Clifford Strock
Editor, Air Conditioning, Heating and Ventilating

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by John F. Sandfort
Associate Professor of Mechanical Engineering, Iowa State College

Those thermodynamic fundamentals which apply to heating and air conditioning engineering are reviewed, beginning with elementary concepts and developing more complex principles with examples of their application. This will be a refresher for engineers in practice as well as a guide for those who are in training in the fields of air conditioning, heating, or ventilating.

20 Pages Paper Bound $2.00

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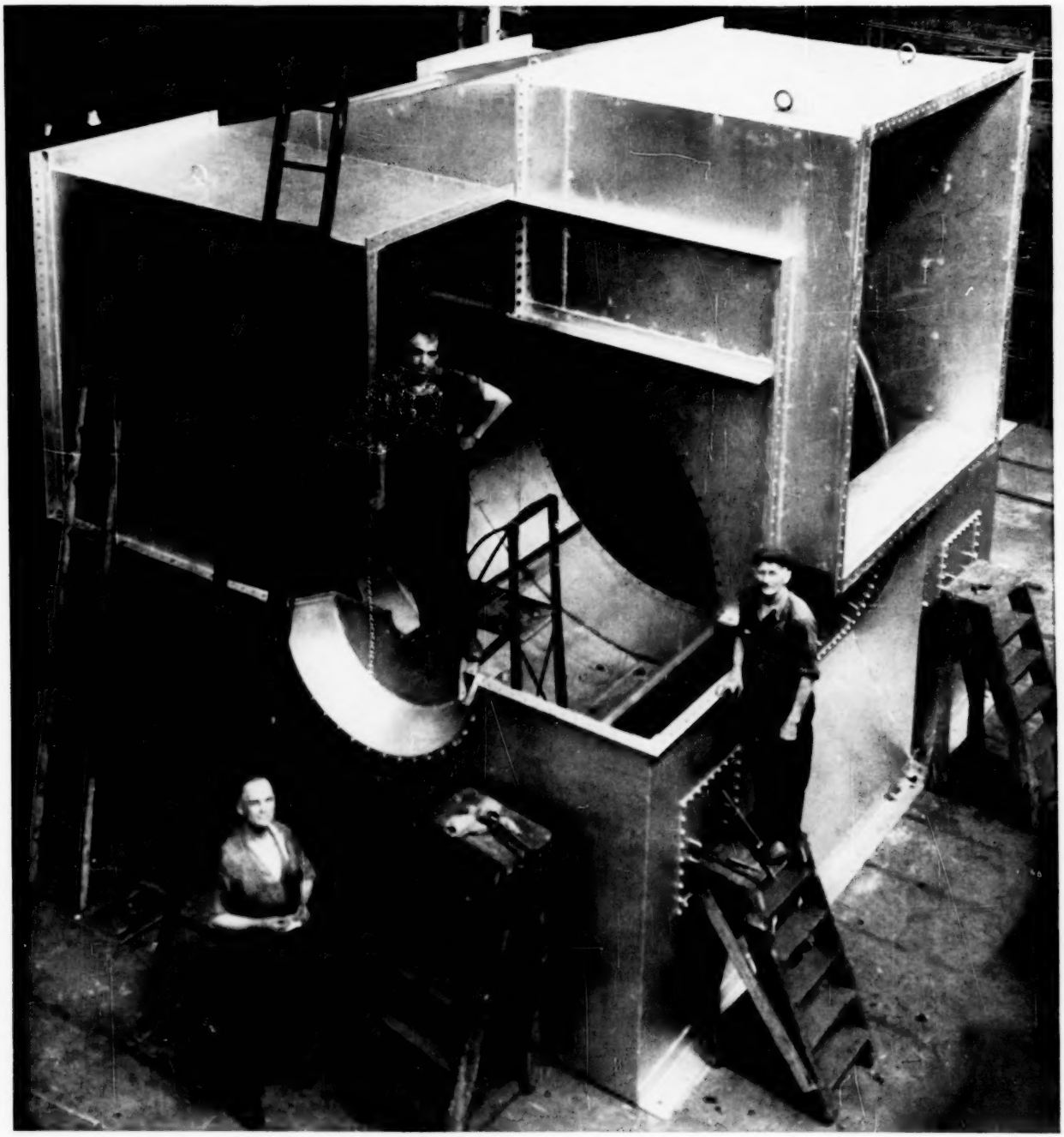
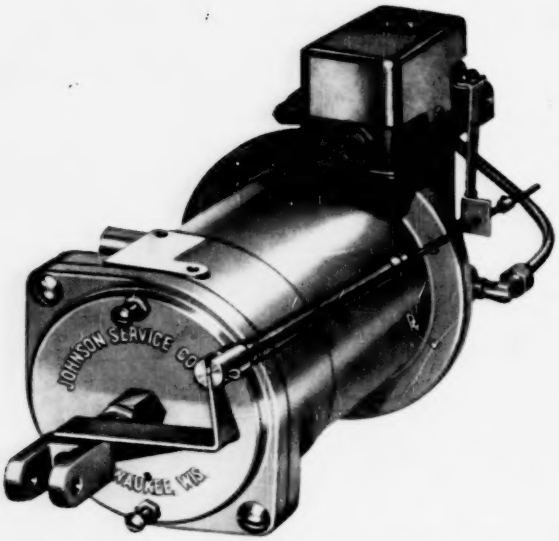


You wouldn't buy a bargain basement parachute... or a cut-rate big game rifle...

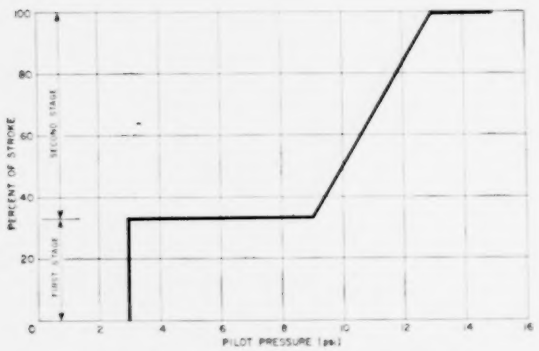
Don't choose less than Clarage quality for your mechanical draft service. With anything as vital as uninterrupted operation, it pays big dividends to get the best in equipment. Clarage, a specialist in building forced and induced draft fans, offers you equipment having a long-standing reputation for long-lasting service. CLARAGE FAN COMPANY, Kalamazoo, Michigan.

JOHNSON D-267 DOUBLE RANGE PILOT POSITIONER

FOR TWO-STAGE OPERATION OF UNIT VENTILATOR DAMPER OPERATORS



D-267 DOUBLE RANGE PILOT POSITIONER
APPLIED TO No. 4 D-251 PISTON DAMPER OPERATOR



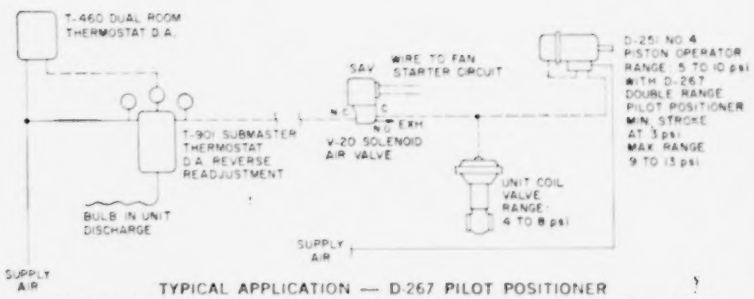
TYPICAL RELATIONSHIP BETWEEN OPERATOR
STROKE AND PILOT PRESSURE

The Johnson D-267 Double Range Pilot Positioner provides two-stage operation of piston damper operators. It is specially designed for application to schoolroom unit ventilators to meet minimum outdoor air requirements.

Features include:

- *First Stage Operation* — two-position action only. Stroke can be adjusted from 0 to 60% of total piston stroke.
- *Second Stage Operation* — proportional operation, with both starting point and operating range adjustable.
- *Accurate Control* — full control air supply pressure is used for repositioning operator at all times. Assures precise, dependable control. Pilot eliminates effects of friction, changes in air velocities, or other variables.
- *Mounting* — may be mounted in any position. Available with type "OS" or "W" mounting plates.

For complete information write for Bulletin D-267. Johnson Service Company, Milwaukee 1, Wis.


T-460 DUAL ROOM THERMOSTAT D.A.
SAV
WIRE TO FAN STARTER CIRCUIT
D-251 NO. 4 PISTON OPERATOR RANGE 5 TO 10 psi WITH D-267 DOUBLE RANGE PILOT POSITIONER MIN. STROKE AT 3 psi MAX. RANGE 9 TO 13 psi
T-901 SUBMASTER THERMOSTAT D.A. REVERSE READJUSTMENT
V-20 SOLENOID AIR VALVE
EXH
UNIT COIL VALVE RANGE 4 TO 8 psi
BULB IN UNIT DISCHARGE
SUPPLY AIR
SUPPLY AIR

TYPICAL APPLICATION — D-267 PILOT POSITIONER
CONTROLLING OUTDOOR AIR DAMPER IN SCHOOLROOM UNIT VENTILATOR

OUR 75TH YEAR

JOHNSON CONTROL

PNEUMATIC SYSTEMS

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